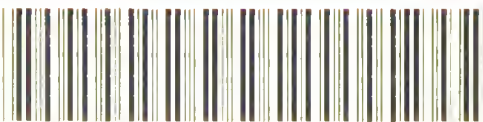


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THE
EQUINE DISEASES
OF INDIA
—
BURKE.



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THE
EQUINE DISEASES
OF INDIA



BY

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ON VETERINARY SURGICAL PATHOLOGY, A TREATISE ON 'BARSA'TI'
OR EQUINE CANCER, ETC.

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PRINTED AT THE STAR PRESS, JUBBULPORE.
1887.

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DEDICATION.

TO

GEORGE FLEMING, C. B.,

F. R. C. V. S., L. L. D., ETC.,

PRINCIPAL VETERINARY SURGEON OF THE BRITISH ARMY, AND PRESIDENT OF THE
ROYAL COLLEGE OF VETERINARY SURGEONS,

WHOSE LABOURS IN THE DEVELOPMENT OF VETERINARY SCIENCE AND PREVENTIVE MEDICINE

HAVE RIGHTFULLY EARNED HIM

A PROUD POSITION,

AS THE ACKNOWLEDGED HEAD OF THE VETERINARY PROFESSION;

AND FOR THE FOSTERING CARE WHICH HE HAS BESTOWED TOWARDS IMPROVING

VETERINARY LITERATURE FOR NEARLY THIRTY YEARS;

BUT NOT LESS IN ADMIRATION OF HIS GENIAL DISPOSITION

AND PERSONAL CHARACTER,

THIS VOLUME IS DEDICATED,

BY THE AUTHOR.



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PREFACE.

The wide distribution of equine diseases and their disastrous effects upon the horses of the country in which they prevail, and the obstacle they constitute to the progress of horse-breeding, rearing and supply, is not generally realised in India, whereas it is a subject which should attract the attention of the Government of India, inasmuch as these diseases materially increase the cost of administration. We as a profession have had some experience of them, and the importance of the subject is enormous, but, withal, little or nothing has been done towards understanding their etiology, or the precise conditions necessary for their existence or production. If we examine the widespread distribution of diseases in India, we cannot fail to be struck by the immense loss they occasion to the country, and by the indifference of the people where they prevail. No one who has not paid attention to the subject can form any idea of the annual loss which natives of India are subjected to in having no right advice available to treat their animals when attacked by any sort of disease or suffering from any accident. The native, as is well known, classes almost every description of disease under one head, and if his usual remedy is of no avail, he submits to fate and looks upon his loss as a dispensation of Providence. It would be as well, therefore, if the Government of India would lend its countenance to some general scheme for diffusing veterinary knowledge which would benefit owners of animals throughout the country. We hope that such a useful suggestion, even amongst the pressing requirements of the Government of India at present, will not be neglected. This is a practical suggestion of the very greatest interest, and also of the very greatest importance to the subject, as tending to show the native classes the conditions necessary for the development and spread of animal diseases. There is, however, one very great difficulty in this question, that animal suffering is considered so lightly that, unlike the human diseases such as cholera and typhoid fever, &c., it does not attract the attention of the people, and still less of the Government, and thus we are led to argue the presence or absence of disease

and its consequences, from the history of individual outbreaks. And, lastly, the Government of India should concede some means of encouraging original research, and the publication of original manuals on special diseases affecting the horse in India, and promote scientific advancement, by instituting a system of rewards or acknowledgments, which would prove a stimulus to the energies and abilities of many who are in every way competent to undertake useful work, but who will not do so without some such rewards in view.

The diseases I have chosen for consideration are of great importance, not only in their general aspects, and from a practical point of view as influencing the spread of knowledge regarding those diseases among the people, but they have a special interest for the practitioner and military veterinarian. Like all other branches of veterinary science, the investigation of diseases in equine patients has made in recent years considerable progress, and opinions and views formerly held in reference to their nature, are now regarded as untenable.

When I first undertook to write this work, I proposed to go over the whole field of inquiry relating to all the diseases affecting the horse-tribe in India, but I soon found that it would be impossible to treat the subject at all exhaustively, or even fairly, without materially increasing the cost of printing, and therefore I must content myself with giving in outline a sketch of the most prevalent diseases, and dwell with greater detail on those points which have more especially excited interest, or in which I have personally made some investigation.

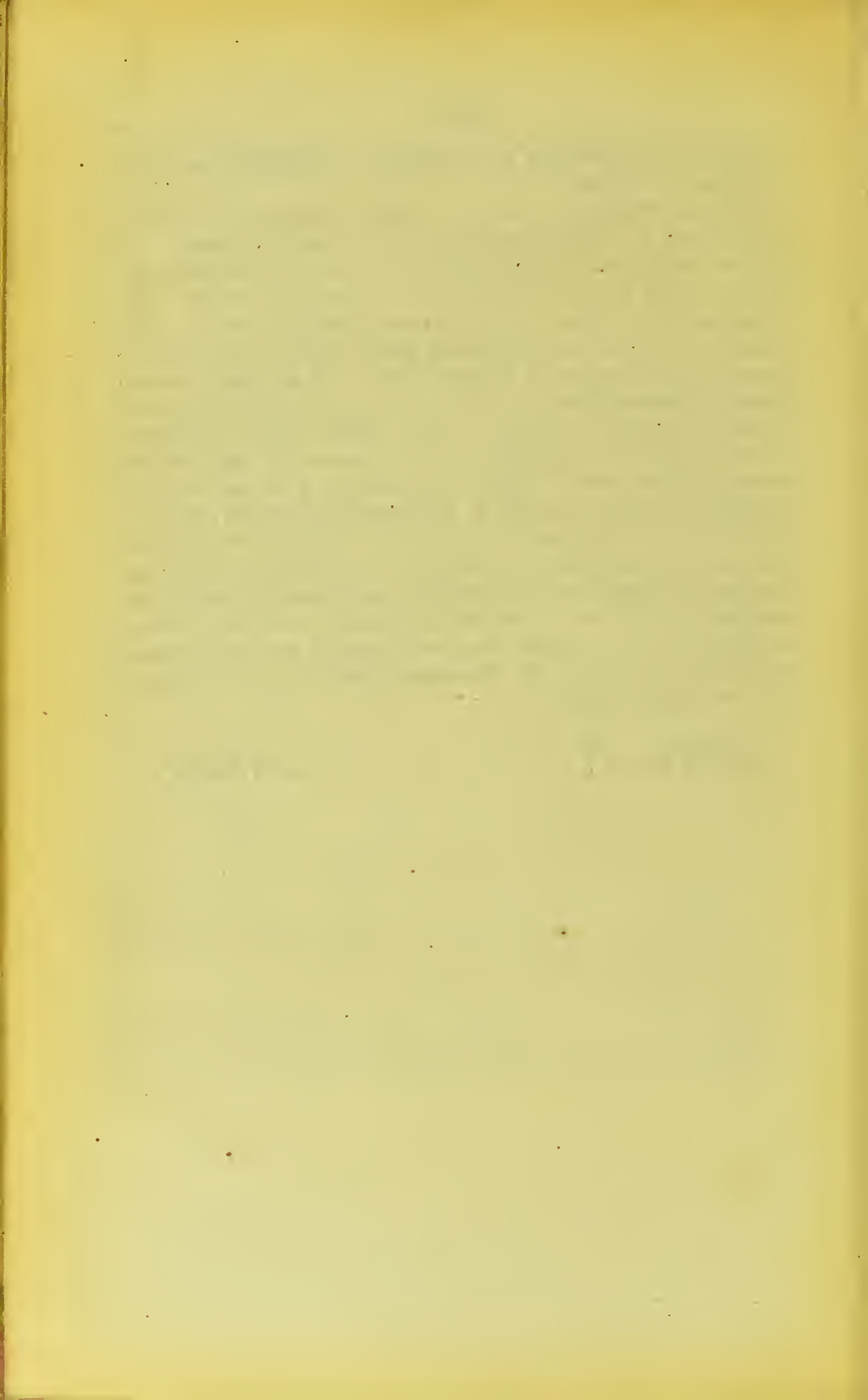
Many disjointed contributions have been made in various veterinary journals, regarding the diseases under consideration; but, so far as I know, no adequate attempt has been made to systematise the knowledge which has been gained; and the work of many others appears in separate fragments, published at long intervals of time, which have furnished aid in some measure to further research. I the less regret that I have not been able to exhaustively treat of all the diseases to which the horse is subject in India, since simultaneously with the publication of this manual appears that of a larger and more extended work by me on Veterinary Surgical Pathology, written in conjunction with, and translated into Urdu by Mr. J. Burke, which has been especial-

ly printed for students who are preparing for employment under the Government of India.

Lectures, without the aid of text-books and guides, have not so far permitted of educating natives in the true sense of the term:—the *salootrie*, willing and ready to learn as a rule, no doubt, but absolutely helpless, takes the place of the regular assistant. He does the work to the best of his ability, but he is a poor substitute after all. The result is a very heavy mortality among animals which could certainly be prevented if the standard of education were raised and good literature backed by practical training. On the plea of economy the Government of India should find it advisable to look carefully after the health of animals, whether the property of native owners and others or those belonging to the Army. In nearly every country in Europe, excepting England, veterinary teaching is encouraged by the State, and chairs are endowed in the leading Universities and Colleges for veterinary professors who lecture upon special subjects in veterinary science: and hundreds of pounds have undoubtedly been annually saved to the countries by this system. India alone, a tropical country where disease is always rife among animals, has been neglected, and only a solitary school established under the Government, and the rate of mortality is consequently excessive.

JUBBULPORE;
July, 24, 1887. }

R. W. BURKE.



“SURRA,” OR PROGRESSIVE PERNICIOUS ANÆMIA.

AMONG the most important diseases in medicine are the so-called constitutional blood disorders: Anæmia, Chlorosis, Leukæmia and Pseudo-leukæmia—which are so little understood. Also Pernicious Anæmia, the etiology of which is still obscure. Since its discovery by Addison in 1835, and the early observations of Biermers in 1868—1872, a very great deal of information regarding its general features has been made out, chiefly through the observations of Quinke, Eichhorst, Zenker, Immermann, Ponfick and others. We may explain, very briefly, our present amount of knowledge with respect to its etiology, symptomatology and *post mortem* appearances considered generally and specially. We recognise, in the human subject, principally two forms of pernicious anæmia—idiopathic or essential, and symptomatic.

The causes of the first form, which is the essential disease, are altogether unknown. In general, bad feeding and stabling, and non-hygienic conditions are the usually received causes, in the case of the lower animals; and owing to this, we consider it an ‘infectious disease’; or, it may be regarded as a constitutional disease of the blood, and of the red bone-marrow. All the cases which have come under observation have hitherto proved incurable.

The causes of the second form are better known. This form is caused by a certain blood-sucking intestinal worm, principally the *Ankylostomum (Dochmius) duodenale* and *Bothriocephalus latus*. This was first pointed out by Perrencito, in 1880, to be the cause of progressive pernicious anæmia among workmen and others. This form of anæmia is to an extent curable. The disease was first described in India under the name of “Surra,” as occurring commonly in horses, mules and camels, by Inspecting Veterinary Surgeon G. Evans, M. D., of the Army Veterinary Department, who noted the presence of a parasite in all the diseased animals examined, and in others subjected to experimental inoculations. The nature of the parasite, and its exact pathological significance are points which Dr. Evans did not satisfactorily

clear up; although, the suggestion subsequently made by Veterinary Surgeon Steel, that it was a spirillum, would not be accepted by him, who maintained that, whatever it might be, it was not a member of the family of bacteria. Dr. Edgar M. Crookshank (*Journ. Mier. Soc.*, Ser. 2. Vol. VI, 1886), who carefully studied the parasite in 'surra' blood, agrees with Dr. Evans in considering it to be not a spirillum, and proposes to name it after its discoverer, *trichomonas Evansi*. Professor Osler (*Brit. Med. Journ.*, 12th March, 1887) prefers to name it *hæmatomonas Evansi*. But the relation of this parasite to the disease has remained an unsettled question. I may add that parasites were discovered in perfectly normal blood, many years ago. I will mention the names of a few observers only, namely, Delafond and Gruby (*Recueil de Med. Veterinaire*, 1843, 1844, 1851), Serres (*Journal du Midi*, 1854), Krabbe (*Repertorium der Thierheilkunde*, 1871), De Silvestri (*Il Med. Veterinario*, 1871), and, three years later, Lewis (*The Pathological Significance of Nematode Hæmatozoa*, 1874). Some interesting papers may be consulted on this subject also in *Giornale di Pisa*, 1877, and in the *Deutsche Zeitschrift für Thiermedizin u. vergl. Pathologie*, 1882, and elsewhere.

M. Netter shows (*Archives de Médecine*, 1884) that two of the micro-organisms found in the alimentary canal, in its normal state, are also found, up to a certain distance, in the bile-duct. He asks whether, under certain conditions, these micro-organisms may not pass from the bile-duct into the blood, and thus be the cause of serious lesions. According to M. Netter, the micro-organisms, present in the bile duct are not found in the gall-bladder, in man; but if the former be tied above its duodenal orifice, micro-organisms may be found in the latter on the following day. In that case, however, the bacilli go much further than the gall-bladder: they penetrate the small ducts of the liver, and pass from thence into the blood. The micro-organisms found in the blood and in the bile are the *staphylococcus pyogenes aureus*, and a bacillus which gives rise to culture colonies of an opaque white colour, and very rapid in growth. These two micro-organisms, however, are not always found together: one or the other may be absent. If the infection is due to the *staphylococcus*, the rectal temperature of the animal experimented on rises to 105. 8° F.; if, on the other hand, it be due to the *bacillus*, the

rectal temperature falls to 93. 2° F. M. Netter thinks that similar infection may be produced in the human organism in disease of the liver, as he has already found these two micro-organisms in different affections of that organ. He found the *bacillus* in the inflamed parts of the bile-duct, in a case (brought before the *Societe Anatomique* by M. Potoki) of inflammation of the duct complicated with calculus, and also in the blood of a patient examined by M. Martha (*Arch de Physiol.*, July 14th, 1886). He found the *staphylococcus* in the blood of a patient during an attack of bilious fever arising from lithiasis, and in a case of jaundice complicated with general miliary tuberculosis. In a case of jaundice from hypertrophic cirrhosis of the liver, in which there was fatty degeneration caused by alcoholism, M. Netter found both the *staphylococcus* and the *bacillus*; in another severe case of jaundice, he found the *staphylococcus* in the blood. Finally, he mentions a case reported by M. Brieger, in which the bile-duct was blocked up by a calculus.

The remarkable tendency of the blood to harbour parasites has been a matter of not recent observation. Their characteristic features manifest a disposition to augment in numbers under any shock or depression of the system. Sometimes prolonged exposure to malarious and ill-sanitary influences, debilitating effects from impaired nutrition, from hyperpyrexia, etc., issues in a morbid alteration of the blood peculiarly fitted for the growth and multiplication of these organisms; but, even when no change in the surroundings of the animal is discoverable, a deep impression is often stamped upon the system, leading to their increase. In a recent inquiry it has been shown that these organisms are to be found in no less than 25 per cent of apparently healthy animals.

These parasites are usually classed as filaria, and they do not seem to excite any disease when in moderate numbers. In other cases, apoplexy may result from embolism of the heart and closure of the valves; and also the embryos appear to cause apoplexy by blocking up the capillaries of the brain. Besides this they may cause epileptiform convulsions and anæmia and wasting; also hæmorrhages into the lungs and skin, and varied symptoms.

In all kinds of animals, then, this parasite must exist, ready to resume its active form whenever the conditions of climate, of weakness and ill-health present themselves afresh. Without doubt, the parasites which are the cause of this disease are widely prevalent, and exist in the blood of most animals, but attenuated; and in this state an animal may harbour them in its blood, without showing much, if any, illness. They only become dangerous when, through over-crowding, and other causes, in bodies enfeebled by disease, their virulence becomes exaggerated. Under weakened states of the body, as in 'surra,' doubtless the parasites multiply rapidly, and even assume pathogenic properties. See, in this connection, a remarkable case of "Filaria Immitis in the Heart of a Dog," in the *Veterinary Journal*, 1881. We have here a case where the parasite *became* pathogenic, and too much stress must not be laid on the pathogenic properties of the somewhat similar organisms found in 'surra'. There is strong evidence in favour of the belief that the parasites assume pathogenic properties under favorable conditions: but it should also be stated that the parasite in 'surra' has never been isolated from the blood, and the disease then produced by inoculating healthy animals with it. It is most probable therefore that the parasites in 'surra' are only associated with the disease, the impoverished blood affording a suitable nidus for their development.

Parasites in the blood have been found associated principally with the following diseases, namely, malarial fever in men (Laveran); pernicious anæmia of the horse (Zschokke, Fröhner); pernicious anæmia of the human subject (Perroncito, Klebs, Frankenhauser); symptomatic anæmia in dogs and cats (Megnin); and simple intermittent (*quartan*) fever of the horse (Burke); etc.

Pathology.

Zschokke first described this disease in the *Schweizer Archiv für Thierheilkunde*, Bd. 25, 1885, under the name of pernicious anæmia of the horse, and also noted the presence of spiral organisms in the blood, the same as those observed by Klebs and Frankenhauser in the human subject. The presence of these organisms, he considers, accounts for the infectiousness of the disease. Fröhner also saw organisms in the blood

of the horse between the red corpuscles; they were from $\frac{1}{3}$ to $\frac{1}{2}$ the size of a red blood corpuscle, but were not quite so thick. Fröhner found them usually grouped together in fours and sixes. (*Archiv für Wissen. und Praktische Thierheilkunde*, Band XII, 5 u. 6 Heft, 1886). The common people in Germany believe this disease to be in some way connected with a non-hygienic state of the stables. Veterinary Surgeons of the Army, on the continent of Europe, have generally described it under the head of lung disorders of an infectious type. Until my own observations were published (*Supplement to Report on Remittent Anthrax*, 5th March. 1887), veterinarians in India had treated of it under different names, as 'surra', relapsing fever, etc.

Other animals, besides the horse, have been known to suffer from the disease. Megnin describes a symptomatic type of this disease seen in dogs and cats, which was caused by an ankylostome producing anæmia, and which is, without doubt, similar disease to the symptomatic form of anæmia in man. Johnes saw this disease in the dog as a secondary affection following a suppurative form of disease. Imminger has observed enzootic outbreaks of it in cattle. Fröhner describes having only recently seen cases of this disease in the horse, and Friedberger also saw an outbreak of it in the same animal. The cases described by Dieckerhoff, under the name of "scalma," are undoubtedly the same disease. The latter author mentions nine cases which, although of a milder nature, showed symptoms allied to those of pernicious anæmia. Dieckerhoff considered it infectious.

Etiology.

Dr. Ponfiek's experiments show that pernicious anæmia may be experimentally produced in dogs and rabbits by administering blood-dissolving agents to them for some weeks, but especially glycerine, pyrogallie acid, &c., which always produced a state of lethargy and extreme weakness in these animals, the mucous membranes becoming pale and anæmic, the action of the heart very irregular, with blowing sounds heard on auscultation of the latter organ, the pulse also weak and the temperature raised. The excrements were sometimes mixed with blood. A microscopic examination of the blood showed a pretty normal

condition of things, in the first week; from the third to the fourth week, the blood became pale and watery with an excess of white cells in it. On dissection of the body marked anæmia was found, with fatty degeneration of the muscles of the heart, of the intima of the veins, the liver, and kidneys; and blood-vascular extravasations in internal organs, but principally in serous membranes, in the lungs, the brain, the spinal marrow, subcutis, etc.

Professor Ponfiek thinks that the blood-dissolving agents cause separation of the hæmoglobin from the blood-corpuscles, leading to marked disturbances in the relative proportion of the blood constituents. The leucoeytosis, which is a marked feature of pernicious anæmia, is also characteristic of hæmoglobinuria, and which in acute and subacute cases is always present. An excess of free hæmoglobin in the spleen, liver, and kidneys may probably be a cause of swelling of the organs seen in this disease. The continued loss of hæmoglobin from the blood interferes with the formation of new blood in a very serious manner. The author has proved by further examinations that free hæmoglobin in the blood destroys the white cells and promotes the growth of fibrin ferments. Large quantities of these ferments cause a marked disturbance of the circulation, the blood flows slower than under normal conditions, which necessarily interferes with the proper function of the blood-forming organs. The body becomes poorer and poorer through the large numbers of the red blood-corpuscles becoming destroyed in this disease, and through loss of hæmoglobin and oxygen : which cause defective nutrition leading to excessive deposition of fat in the principal organs of the body, and which is the cause again of hæmorrhages in different organs. (*Berliner Klinischen Wochenschrift*, 29 and 30, 1886).

One cannot refrain from pointing out the very meagre evidence we possess, in the face of these experiments, with regard to the share taken by the parasites met with in the blood of 'surra.' The results of these experiments at once suggest to our mind an explanation with regard to the numerical increase of the parasites as a consequence of impoverished blood in this disease.

Dr. Crookshank states that the closest examination has confirmed his belief "that the parasites found in the blood of healthy rats are

morphologically identical with the stained parasites of surra." Dr. Evans noted the presence of filaria of different species in the blood of diseased as well as healthy camels (*Veterinary Journal*, July, 1881, p. 10), and Crookshank notes the same fact in the case of filaria found in the blood of rats. Since all observations prove the existence of filaria of different species in the blood to be compatible with health, we have no reason for wonder when we find them greatly increased during disease.

It should be further stated, as Dr. Crookshank points out, that the organism has never been isolated from the blood in surra, and the disease then produced by inoculation of healthy animals,—a point of considerable moment in the etiology of this disease.

Symptoms-

The appearances during life are principally those of a general loss of blood, indicated by anæmia of mucous membranes, languor, dyspnœa, a weak and readily excitable pulse, palpitation of the heart, and fever. There is increasing debility, with little or no loss of appetite. In spite of a greedy appetite, debility appears progressive in character. Dropsical swellings usually occur towards the latter stages of the disease. The malady is usually progressive, seldom acute in character. The course is sometimes prolonged to several, usually six to eight weeks; the average duration of the human disease (pernicious anæmia) being also estimated at "two months."

With regard to the fever accompanying this disease, Mr. Steel has noted an unlimited number of remissions on the 4th and 5th days usually, which he mistook for the remissions seen in relapsing fever. Zschokke has shown that the fever accompanying these cases is of an intermittent type. Fröhner has likewise noted a marked rise in temperature on the 4th day, which, with slight remissions, remained high till death. Fröhner also saw partial paralysis, or an increasing weakness of the hinder quarters in horses, the subject of this disease, a symptom which was often observed in the Burmah outbreak. Zschokke mentions jaundice as another frequent symptom in the horse, as well as enlargement of the lymphatic glands and punctiform extravasations—symptoms commonly

noted in surra in India. The urine is albuminous in character, and of an acid re-action.

Post Mortem Appearances.

On dissection, a general anæmia, together with fatty metamorphosis, unattended by other changes, is noted. Frequently, though not always, hæmorrhages take place more or less in all the organs, but principally in the serous membranes, the muscles, the retina, and the larger glands. The spleen and liver are sometimes swollen, and contain thrombi in the larger vessels. The marrow in the bones appears altered in character, and presents a jelly-like aspect, containing innumerable granular blood-corpuscles. The liver and other organs contain an excess of iron-salts. The true pathological cause is to be found in the blood: the red blood-corpuscles are decreased in number and altered in shape, size and aspect, frequently presenting a markedly serrated outline. Nodular blood particles are also to be seen in the blood. In short, the blood is in a state of complete disorganisation.

Zschokke states that none of the principal organs show any, marked structural change. Besides anæmia, he has noted hæmorrhages under the serous membranes, swelling of the liver and spleen, loss of striæ in the muscular fibres of the heart, blood extravasations in the marrow of bones, and a decrease in the number of red corpuscles in the blood, the same as in pernicious anæmia in man. He also noted the presence of spiral organisms in the blood.

Gastric ulcers were frequently seen in the Burmah outbreak in Transport mules; and it is a matter of fairly common belief that chlorotic women are especially liable to gastric ulcer, and to the worst accident of such a lesion, namely, perforation; and in this the Burmah disease was not peculiar. The ulcer itself, once formed, probably suffers from nutritional defect owing to the impoverished state of the blood which prevents the formation of resisting tissue around it. This lesion is not, however, present in all outbreaks of surra, as Dr. Evans also, who was the first to describe this disease in India, makes no mention of it in his report. It is possible also that a great many cases of gastric ulcer in the Burmah outbreak were complicated with remittent fever of equines (Burke), which is not at all an uncommon disease of tropical

-climates, and may be frequently seen prevalent not alone in Burmah, but in many parts of India also.

Mr. Oliphant, Principal Veterinary Surgeon in India, in his D. O. dated 12th February, 1887, writes:—"In one outbreak of surra in the 18th Bengal Cavalry, in which 180 horses died, I made dozens of *post mortem* examinations, and the appearances in all were identical—extreme pallidity of all the tissues, with perhaps a trifling serous effusion into the abdomen, &c. In fact, the animals looked as if they had been starved to death." Dr. Evans was also most careful in pointing out that absence of any marked structural changes was peculiar of surra (*Veterinary Journal*, July 1881, p. 6). The other symptoms, such as the adipose degeneration of the liver, spleen, heart and other organs, the gastric ulcers, the general hæmorrhagic diathesis, &c, may be regarded as secondary in origin.

Diagnosis.

The marked anæmic conditions, observed both *ante* and *post mortem*, the leucocytosis, fatty degeneration of the muscles, liver, spleen, kidneys and other organs, the general hæmorrhages, and the chronic state of fever,—which end in death in so many cases, leave no doubt as to the nature of the disease.

Treatment.

In all forms of serious anæmia, authors have always attached the greatest importance to treatment by arsenic; and in a recent paper by Professor Osler, in the *Therapeutic Gazette*, he states that in all cases of pernicious or essential anæmia there was no one case of recovery in which arsenic did not form the basis of treatment. It is not however, a specific. Iron is only occasionally useful in these cases. Mr. Steel also mentions these remedies in the treatment of 'surra,' although he met with no greater success than usually follows their use in pernicious anæmia in man. Exercise would appear to be more favourable to recovery in these cases than absolute rest. Change of climate has been found occasionally useful, both in the case of man and in that of the lower animals. And Sir Joseph Fayrer—who even suggests that "beri-beri"

in man is probably one form of pernicious anæmia—thinks that a hilly climate is particularly suitable for the less advanced cases, although he admits its efficacy in more prolonged cases to be somewhat doubtful, if not altogether *nil*.

The prevention consists in sound hygiene, care in avoidance of stagnant water, and protection from vicissitudes and extremes of climate.

The whole subject of parasites and parasitism in equine medicine, is one which has yet to be studied completely: but, as a clinical observer, I believe that I can recognise in surra a pathological state which has a curious relation to pernicious anæmia in man, which I have endeavoured to bring out in this paper for the benefit of English-speaking veterinarians in India in particular, and to associate it with that disease of the lower animals long since recognised by veterinarians on the continent of Europe, but especially by Megnin, Johnne, Imminger, Zschokke, Friedberger, Fröhner and others.

ANTHRAX.*

NUMEROUS articles have lately appeared on Anthrax as it affects animals in India, but I do not think the subject has been advanced any further than was already known regarding it many years ago. Recently Mr. Smith has written somewhat at length on the subject, but he has considered only two forms of that malady, namely an abdominal and respiratory, which he treats of very fully. Without going into details, I may be permitted, in the short space at my disposal, to record the salient features of the disease, and the different clinical aspects it presents, from my own experience of it.

Although always the same disease, dependent on a common cause, its modes of manifestation vary considerably in different outbreaks and in different cases in the same outbreak. My experience leads me to recognise the following divisions, which may be made for convenience of description, *viz.*, the respiratory, gastro-intestinal, renal, hepatic, nervous, subcutaneous or carbuncular, cutaneous, and intermittent and remittent forms. In some works on veterinary pathology the above are divided into internal and external forms of anthrax: this division has many supporters, inasmuch as the fatality varies so greatly in the internal and external forms of the disease, requiring separate description. There is no doubt, too, that frequently one type of the disease runs into the other, and sometimes one or more types co-exist; but according to my experience, the external form seldom leads to the internal, and, when not a complication, is generally less fatal than it.

1. The RESPIRATORY form of Anthrax shows itself as a specific pneumonia. This form of the disease has been very clearly sketched by Toussaint, and need not call for description here.

2. GASTRO-INTESTINAL form of Anthrax presents all the symptoms of acute gastro-enteritis and *post-mortem* examination shows the effusions peculiar to anthrax, which do not appear in simple gastro-enteritis. Occasionally, the lesions of anthrax located in the alimentary canal are so marked, that symptoms of acute dysentery, with

* See *Veterinary Journal*, Feb., 1887.

œdema, degeneration, and sloughing of the mucous membrane in small patches, and even prolapsus recti, result. Death results usually in about seven hours, although it may be earlier in some, and later in other cases.

3. THE RENAL form of Anthrax is ushered in with symptoms of acute nephritis, and rapid death, owing to inaction of the kidneys and uræmia. *Post mortem* examination shows changes peculiar to anthrax located principally about the kidneys and in the renal structure. The presence of the *bacillus anthracis* may be detected on examining sections of the latter organ under the microscope, in the afferent and efferent vessels, in the glomeruli, and even in the parenchyma of the kidney outside the vessel walls, and in the uriniferous tubules. Consequently, the urine is a source of danger in outbreaks of anthrax, and the bedding of affected animals should be always burnt.

4. THE HEPATIC form, where, according to my experience, the symptoms of hepatitis follow in the course of the general symptoms peculiar to anthrax. It seldom appears as a primary symptom. Consequently I look on it as more a result, than a distinct variety of anthrax. Some observers, however, maintain that the symptoms of hepatitis are prominent from the first, and, therefore, believe the hepatic disease to be a distinct form of anthrax.

5. THE NERVOUS, or NEUROTIC forms.—I recognise three distinct varieties of this form of anthrax in India, which I may divide into the apoplectic, the furious, and the paralytic. An animal, without having shown any signs of illness, will suddenly fall to the ground, as if struck by lightning. In other cases the animal trembles, showing laboured breathing, a weak, small character of the pulse, and marked palpitation; is stupified, stumbles about, and becomes very excitable and unmanageable towards the close, often tearing his own flesh with his teeth (furious anthrax). Convulsions usually precede death. Sometimes paralysis sets in early in this disease, death taking place usually a few minutes after the animal has fallen to the ground.

The APOPLECTIC form is the most common variety of anthrax met with among camels in India, while it is occasionally seen also in horses and in oxen. The furious and paralytic forms are chiefly seen in the

horse. It is well known to the Gernans; for, I find Röhl, in his *Lehrbuch der Pathologie und Therapie der Thierärzte*, 1885, says, that the common people in some parts of Germany speak of it as the Devil's shot, blood-plague, etc.; and he regards it as a very frequent variety of anthrax in Germany.

Horses usually drop to the ground suddenly, and expire without a struggle. Camels, in most cases, "run wild" for about fifty paces or so, and suddenly drop to the ground as if shot, and usually die without a struggle. Dr. Röhl believes death follows through paralysis of the lungs and heart's action. My observations of a great many cases lead me to confirm this view, while in other cases in which death was more rapid, or I may say instantaneous, death, in my opinion, was caused by shock. *Post-mortem* examination shows no congestion of the brain, and hence some object to the use of the term apoplectic. If so, we may speak of it as that form of anthrax in which death usually takes place by nervous shock, to avoid misapprehension.

Diagnosis: The furious and paralytic forms of anthrax are liable to be mistaken chiefly for rabies. When paralysis is the main symptom, the diseases with which it may be mistaken are rabies, kamri, beri-beri (Wallace Taylor), remittent fever (Burke), and other diseases of the blood attended with effusion on, or changes in the spine. Diagnosis will be rendered easy by (a) microscopic examination of the blood and other tissues showing presence of the bacillus anthracis peculiar to anthrax; by (b) the history of the case, and the appearance of the disease in other forms in other animals; and by (c) the course and symptoms of the disease.

6. CARBUNCLE.—Is the Ludhiana* form of anthrax, and occurs as a subcutaneous infiltration and enlargement which, in the horse in India, is seen chiefly under the jaws and region of the throat.

*We have sometimes wondered why, in these days of reformed spelling, grammarians, translators, and lexicographers as they are, cling to Lodiana as the proper spelling of this well known station. We have even suspected that their way must be right and the official "Ludhiana" wrong. But we learn from several recent references, that Ludhiana, pronounced Loodbhiana, gives the sound as nearly as possible in English letters. When the British veterinarians went there in 1841 to investigate the disease which is named after the station, they found that some Civilians had invented an etymology for the name, as the abode of the Lodi, and were calling it Lodiana, so they did the same. And it has become more difficult each outbreak since, to change the widely known name of the "Lodiana Disease".

Dieckerhoff, of Berlin, agrees with us in this opinion (*Lehrbuch der Speciellen Pathologie and Therapie der Thierärzte*, 1885). It leads to death usually from suffocation, owing to the mechanical obstruction that results from œdema of the larynx. In cattle and other animals the swellings appear in different parts of the body, and in the camel, especially on inside of both thighs.

The swellings are diffuse or circumscribed, sometimes fluctuating, but usually tense, and there is no crackling sound communicated to the fingers on percussion.

Bollinger and Feser in Bavaria, and Arloing, Thomas and Cornevin in France have noted the presence of the bacillus anthracis in the blood and other tissues of animals affected with *Emphysema Infectuosum* and have concluded that the presence of the organism confirmed the identity of *Emphysema Infectuosum* and anthrax beyond doubt. But, it is also known that "Anthrax very frequently makes its appearance at the same time as *Emphysema Infectuosum*" (Röll); and we have no evidence to show that the two diseases have not often co-existed in the same animal.

Hess* has now shown that milzbrand and 'rauschbrand' (*Emphysema Infectuosum*) are not the same disease. The fungus causing the latter has been carefully studied by several authors, but it is difficult to say whether the descriptions of Arloing, Feser, Ehler, or William Koch are the most correct regarding its chief characteristics. Feser and Arloing's observations show that the bacillus is constantly found in the body of animals affected with rauschbrand, and that the disease is inoculable. The fungus remains in a spore form in the body, and all the disease changes are dependent on this, which is, at present, a large fact in itself, although not a complete enough one.

Although *Emphysema Infectuosum* has great resemblance to anthrax proper, it is clearly a disease of its own, having nothing in common with anthrax, for the following reasons :

*E. Hess, Bericht über die entschädigten Rauschbrand und Milzbrandfälle im Kanton Bern Während der Jahre 1884 und 1885, nebst einer Wissenschaftlichen Abhandlung über den Zusammenhang der atmosphärischen Einflüsse mit dem Rauschbrand, Bern, 1886.

(a) The fungus of *emphysema infectuosum* is, according to Arloing, quite distinct, both in its morphological characters and mode of growth, from the bacillus anthracis.

(b) *Emphysema infectuosum* cannot be communicated to rabbits and young calves, and only in a mild form to horses, donkeys, and white rats, which take anthrax readily by inoculation.

(c) A large quantity of fluid is requisite in order to transmit *emphysema infectuosum* from one animal to another, whereas a very small quantity suffices in the case of anthrax.

(d) Injection of a small quantity of virus protects against future attacks of *emphysema infectuosum*, but gives no immunity against anthrax.

7. The Cutaneous form of Anthrax; in which the structures of the skin are primarily invaded, leading to eruptions, boils and abscesses. This is the least dangerous form of anthrax, because results due to changes in the skin are not at all comparable with those following changes in more important organs of the body, as the lungs, intestines, kidneys, etc. The functions of the skin can be taken up more easily by the lungs and kidneys, than those of the latter can by the skin, when labouring under disease or derangement. And this fact has often been overlooked, it has seemed to me, in considering the relation of external to internal anthrax.

8. Intermittent Anthrax is that form of the disease where the animal revives after an attack, and some days after a relapse occurs, and the case is often entered as a fresh one. This form of the disease was first noticed, in cattle, by Bollinger; and in the last outbreak of anthrax in Government camels at Cawnpore, I have recorded several such cases.

We have no mention in veterinary literature of simple intermittent and remittent fever affecting the horse, though there is no reason why the lower animals should not suffer from these fevers as well as man. Indeed, that the horse does suffer from the abovementioned types of fever may be assumed as a fact established by the temperature charts

kept by me in the case of ponies belonging to the 8th Hussars, in the last outbreak of this disease which came under my observation in Meerut. These charts, moreover, prove, in the first place, that intermittent and remittent fever in the horse bear the same relation to anthrax as *emphysema infectuosum*, for example, bears to anthrax, and they also, in the second place, demonstrate the possibility of anthrax being complicated with cases of simple intermittent and remittent fever. There are manifestly three distinct kinds of diseases with which the Veterinary Surgeon must in particular contend in future, among others,—intermittent fever, remittent fever, and anthrax; and, very frequently, any one of the above supervening on the other, and even complicating each other, as shown in the outbreak recently investigated by me (See *Supplement to Report on Remittent Anthrax*, 15th March, 1887.)

Besides the abovenamed varieties of anthrax, many cases are complicated with hæmorrhage from natural openings, as the nostrils, urethra, anus, etc. In the case of the nostrils, the serum and blood which escape get beaten up with the air in respiration, and assume a peculiar frothy aspect, which has been especially remarked in the Cape-sickness* of horses, and is not an uncommon symptom of anthrax seen in India. Death frequently results from hæmorrhage into the abdomen and thorax, due to rapid multiplication of the bacillus anthracis and plugging of the capillaries, producing rupture.

I have also to mention in this connection a form of Malignant Sore Throat in cattle † which I was deputed to investigate some time since at Allahabad. I was ordered there to inquire into an outbreak of disease reported as Anthrax. On my arrival at Allahabad, I made inquiries about the number of casualties, and was told the casualties amounted to *nil*, notwithstanding that numerous cattle were affected. This drew my attention to the subject somewhat more closely, and my chief object was to determine how much of truth there was in the general report as to the nature of the outbreak being an anthracoid one. My investigations led me to these conclusions, briefly:

*Wiltshire, *Veterinary Journal*, 1878.

† See Reports Nos. 552 and 553 dated 18th January, 1886, to the Inspecting Veterinary Surgeon, 2nd Circle, Bengal.

(a) Malignant sore-throat in cattle is caused by the *bacillus œdematis*, which is transmissible from oxen to oxen by experimentation.

(b) The fatality is very low, indeed *nil* in cases in which early fomentation and blisters to the throat have been resorted to.

(c) Cause of death is purely accidental, and due to mechanical obstruction of the throat and suffocation. (*Veterinary Journal*, April, 1886). It should be stated here that Drs. J. B. and A. Grosswell have recently investigated this disease in England, and they have confirmed my observations relative to the nature of the germ which causes it. (*Veterinary Journal*, November, 1886). Messrs. Grosswells' work is so good and thoroughly done, that it gives us great pleasure to find our observations corroborated by them. I trust that the cases I have reported may suffice to show that by early treatment of throat lesions, a class of cases hitherto found most intractable, and extremely fatal when left alone to chance, is capable of being very satisfactorily dealt with.

Kitt (*Untersuchungen über malignes œdem und Rauschbrand bei Hausthieren—Münch. Jahresber.*, 1886) shows the resemblance which exists between the bacillus of *charbon symptomatique* and that of malignant œdema, which is so frequently seen in the lower animals. In their clinical and pathological features the two diseases are identical. Kitt shows that the bacillus of malignant œdema is transformed into that of *charbon symptomatique*, which must be considered a common variety, presenting similar biological characters (*Rec. de Med. Veter.*, 15th February, 1887.)

Contagion of Anthrax.

The modes of conveyance of the germs have no special relation to the question of anthrax only: it is not settled by what channels, in each instance, the germs of specific diseases in general travel. Thus, cholera, typhoid fever, etc., have each its suspected sources, but no one source can be made to apply in each particular outbreak. It is possible the germs travel through various channels, some known and others unknown. Among some of the known channels may be mentioned the air (Tyndall); water; grass-roots obtained from burial grounds (Darwin)

of anthrax affected animals, where earth-worms act as the intermediate bearers, and direct contagion from animal to animal. From what I saw of the last outbreak of anthrax in horses of the 17th Lancers and Native Cavalry Regiment at Lucknow about three years ago, I have little faith in air as a medium of contagion in outbreaks of anthrax, as the two batteries of Artillery close to the Native Cavalry Regiment escaped contagion, although not many yards' distant from the Cavalry lines. However, a volatile form of contagion in anthrax is recognised by many observers. Zundel (*Recueil de Med. Veterinaire, May and June, 1871*) recognises a fixed and a volatile contagion in anthrax; and Fleming also mentions it. Many so-called spontaneous outbreaks of the disease may be explained on the possibility of air being a medium of contagion, the germs floating in the air, more during certain conditions than during others, alight on susceptible animals.

Instances of anthrax communication by affected animals, I have only recently reported in the case of this disease introduced among camels belonging to the Army Transport at Cawnpore, on the arrival of affected animals from Allahabad; and also in the case of slaughter cattle at Allahabad about two years ago, through inter-communication of suspected cattle employed in carrying fodder for healthy ones. Such instances could be multiplied *ad infinitum*.

Among indirect means of contagion may be mentioned the excreta of animals affected with this disease, and bedding, clothing, utensils, etc., used by them. Also flies, vultures, jackals, &c., all of which may be active agents in promoting the spread of anthrax. And, lastly, the bodies of affected animals in particular, which should be always cremated. If this were done in the case of village cattle also, and burial prohibited, we should hear less about grass-cutters' ponies introducing anthrax into cantonments than we now do.

The bacillus anthracis, by its excessive multiplication, has a mechanical effect, apart from all other considerations, in impeding the action of the heart, in blocking up the minute capillaries of important glands and preventing secretion and excretion, etc., as evidenced by the symptoms of this disease. In the heart the bacilli of anthrax abound within and around the vessels, and in the interspaces of the muscular fibres.

In the liver they occur in the intralobular venule and its adjacent capillaries. In the kidneys they are found especially in the glomeruli near the surface of the organ, in the afferent and efferent small vessels, and in the uriniferous tubules and in the urine. They exist also in the milk (Burke). In the lungs they are found in great numbers around the alveoli, completely choking the minute capillaries, and leading, in other situations, to rupture, ecchymosis, and effusions. When the effusion is excessive, and near important organs, as around the larynx, it is sometimes the immediate cause of death. It interferes with, or entirely suspends the function of important organs by its pressure. When the effusion occurs under the skin, it frequently constitutes well defined tumours.

The blood in anthrax shows an excess of white cells, with the presence of *bacilli anthracis*, is unusually dark, and does not readily coagulate.

Course.

Regarding the course of the disease, a very important research, bearing on the conditions of infection of specific diseases, has been recently made in England. In this research it has been pointed out that the initial dose of virus is of great importance, and in many instances exercises a marked influence on the *course and virulence* of the disease. Various laws have now been made out—for example, the pathogenic dose of a virus varies inversely with the predisposition of the animals to the disease in question; in animals not very susceptible to a disease, the severity of the affection varies directly within certain limits with the amount of the virus introduced, etc. It is found that in some cases a small dose of a virus produces only a local effect, while a larger dose kills the animal, and the small dose often protects the animal from the fatal effect of a subsequent large dose. Although it is as yet impossible to measure predisposition, and thus to decide the dose for any animal, still the knowledge of the relation between these two factors is of great importance in throwing light on its spread in many outbreaks; while the fact that a considerable quantity of the virus is in many cases necessary for the production of a disease, explains many anomalies, and affords indications for preventive measures.

There are some animals which will take the disease in a very virulent type, and die rapidly, whilst in other animals the same micro-organisms will prove relatively innocuous, or produce only a very mild attack, characterised by a prolonged course. It is the same with other diseases: each animal has its own idiosyncracies for nourishing and for starving micro-organisms, since every nutrient soil is not equally adapted to the same microzoon. But not only is the difference of the same tissue in different animals the reason of a different behaviour of the same microzoon, the tissue itself, in one and the same animal, may change under different conditions. It is possible that changes may take place in the system of the animal, unknown perhaps to ourselves, but very important to the respective micro-organisms. I will only allude to 'vaccination' as a preventive of disease, which evidently changes the nutrient soil, so that the microzoa of that particular disease can no longer find nourishment, and the vaccinated animals remain unaltered by an injection which would have proved rapidly fatal if non-vaccinated. It is further ascertained, as a matter of observation, that certain micro-organisms cannot thrive well, or do so very imperfectly in one body under certain conditions, whereas they may be pernicious when certain other conditions are present. It is known that, not only in an animal's body, but cultivated in artificial media, bacteria may retain their properties unaltered, or they may undergo more or less modification.

If it is true that not every nutrient soil is equally well adapted to a certain microzoon, that microzoon developing better in one constitution than in another, it must consequently be true, that one microzoon may be so changed that it may occasionally show some difference, according to its surrounding conditions, in its mode of growth and other peculiarities, to such an extent that its pathogenic activity might be lessened or strengthened according to those conditions. This idea is in accordance with what daily experience teaches with respect to plants and animals. Plants put in a convenient soil may grow extremely well, and may, to a certain extent, change their colour, smell and other qualities, but put in a bad soil, they will not thrive, or but imperfectly.

Treatment.

Carbolic acid was first recommended by Dr. Fleming, and found very useful in many outbreaks, and in the *Vratch* several leading articles have recently appeared, lauding the therapeutic value of carbolic acid in the treatment of anthrax in man. Mr. Meyrick suggests that a convenient method of administering carbolic acid is that of employing carbolate of soda. Many years ago, Dr. Beale, in his work on Disease Germs, showed that the carbolate of soda is decomposed in the system, setting free the carbolic acid, and in this way a much larger amount of the acid can be administered without poisonous effects, than when given in the crude form.

As a rule, cases do not come under the veterinarian's care till they are far advanced, or coming early under treatment, run a rapid course, and then, though the best remedies are administered, they have not the power left to imbibe the good which follows in the early stages and milder cases of this disease. Therefore conclusions that are arrived at without due consideration of these facts, show no great exactness in stating the relation of percentages. Among the other agents which have been found useful, may be mentioned iodine and iron, especially the perchloride of iron recently mentioned by Steiger. Although these remedies have their uses, it must not be concluded that they are necessarily calculated to produce a certain cure in every case of anthrax; if such a success could be achieved, anthrax would no longer be the dread malady it has hitherto proved to be. Messrs. Gresswell, of Louth, inform me that perchloride of mercury and sulphite of sodium have proved of efficacy in many outbreaks of anthrax fever in England.

Prevention.

The three essential points in the treatment of this disease are, it is obvious, change of air, change of water, and change of locality on the first appearance of suspicious cases. Such indications are not fulfilled by the ordinary plan in vogue of drugging animals. When a few cases of this disease occur in any regiment, the risks of an enzootic attack are considerably increased by keeping the animals in an anthrax

contaminated locality week after week. Simple segregation of affected animals does not suffice to keep the disease in abeyance. The animals must quit, with the least possible delay (in order to avoid infection) the tainted ground. Extension of the disease is kept up for months by persistent occupation of tainted lines, until considerable loss has been experienced. In order to obtain a favourable result of our endeavours at prevention, it is necessary to undergo the cost of a new flooring, and have recourse to prompt and effectual removal of tainted earth. We must acknowledge that, whilst firmly convinced that dozens of animals may be easily saved by timely adoption of the abovementioned precautions, there are great difficulties and disappointments inseparable from the carrying out of proper segregation, which I believe to be the chief causes of these failures. One great cause of failure, I believe, is inequality of the measures adopted in different outbreaks, when the proper time for prevention had been allowed to pass by. The probability of an extension of this disease, depends less on the special nature of preventive treatment recommended than on inefficiency of such measures as are often employed. The running at large of grasscutters' ponies during an outbreak of this disease is a frequent cause of diminished usefulness of preventive measures which are adopted. It is often forgotten that the most critical time for securing the movement of suspected animals is when the disease is absent in others. It is necessarily of greater importance to avoid contracting disease, than merely to attempt to suppress it among an already infected lot of animals. The extreme importance of preventing at every point the chances of entrance of the contagion into untainted lines cannot very well be exaggerated. A knowledge regarding the period of convalescence is of importance in preventing risk of infection by exposure of healthy animals to one which may have just recovered from an attack and be still convalescent. Anthrax may be communicated by the sick animal when the severity of the illness is past, and while recovery is being perfected, since every secretion and excretion of the body in this disease is a carrier of infection. Too great care cannot, therefore, be taken, so long as cases of this disease appear, in preventing a return of apparently recovered animals, which are at the time even more dangerous than when suffering from an acute attack

and unable to move about. Undue alarm should be avoided, but we must insist on the importance of fresh air, fresh water, and change of locality above all, in the treatment of suspected animals. Recent observations show that a certain local and seasonable condition is essential to the spread of anthrax, these two factors being found in a porous material, the soil, penetrable by air and water, and soaked with organic substances (local predisposition), and in variations in the moisture and temperature (seasonal predisposition). The first essential condition of prophylaxis is immediate evacuation of the tainted ground, the checking of contagion by early isolation of the sick, and by observing the necessary precautions which stave off an attack among the healthy animals. Immunity is also obtained by guarding against exposure, want and debility in the case of grasscutters' ponies, this precaution being found necessary, since transmission of the disease, in these, is often dependent upon constitutional weakness, or upon degrees of predisposition and susceptibility. Acting upon our experience of former outbreaks of anthrax, we may formulate the following rules of prevention, namely :—

(a) Not to return any animals as "fever-free" without having first ascertained, either by the use of the thermometer or other means, that such is the case ;

(b) To remove the conditions of soil favourable to the growth of the microbe, the infected standings must be renewed. The prophylactic treatment of tainted localities by enforcing rules of sanitation, and by avoiding the pollution or infection of the earth with anthrax material—*viz.* cadavers, the manure or offal of diseased animals, will always be the chief means of preventing an outbreak of the disease.

Protective Inoculation.

It is a great satisfaction to learn that the Government of India have under consideration the question of bacterioscopic laboratories being opened in many central stations in India; because there can be no question that such laboratories are necessary, where 'anthrax-vaccine' can be prepared for distribution to the different mounted branches of the service, as well as in the agricultural districts through-

out the country. Looking not only to the interests of the Army, but to the necessities of British India, the death-rate from anthrax in all classes of animals is a terrible calamity, and every Government should do its utmost to avert it. The entire tendency of modern inquiry is in favour of protective inoculation; enormous saving to the country may be effected by organising central laboratories in India for the purpose of sending 'vaccine' fluid into the agricultural districts, and it is difficult to see how postponement of such an evident means of saving to the country is possible. In some parts of Russia where anthrax is very frequent, carrying off some thousands of animals of that country annually, preventive 'vaccination' has reduced the mortality from this disease to 2 per cent., as in every other country in Europe. It may therefore be considered as the most urgent necessity which the Government of India have now under consideration.

PROTECTIVE INOCULATION has been practised by virus enfeebled (a) by heat (*Toussaint, Pasteur, and Chauveau*); (b) by antiseptics, (*Chamberlain and Roux*); and (c) by cold (*Gibier*); also (d) by Kitt's practical method, i. e., inoculation of guinea pigs with Pasteur's attenuated virus; and (e) with the blood of rabbits which have succumbed to inoculation (*Pasteur, Chauveau, Perroncito, Kitt and others*). Immunity from infection is also obtained by injection of chemical bodies, as the perchloride of mercury, etc., in which it is seen that after animals have taken a sufficient quantity of the drug, they are no longer liable to anthrax.

“KAMRI”, OR PARAPLEGIA.

The word *kamri* is derived from the Persian word *kamer*, which signifies the loins; *kamri*, therefore, denoting disease of the loins. A somewhat similar disease in man is called “ardhang”, or more literally “adhangi,” *adha* meaning half, and *ang* body, *i. e.* having the use of half the body, or affecting half the body only.

Etiology.

Kamri may be brought on (1) from exposure to damp and inclement weather; (2) by dietetic causes; (3) by surgical conditions; (4) and it may be a result of many specific fevers, especially one form of anthrax, rabies, surra, *kákke*, and other diseases.

(1) Exposure is one of the most frequent causes of *kamri* in India. It has been generally noted that picketting horses outside their stables for a single night will often suffice to bring on an attack of *kamri* in some of them which showed no previous signs of illness. This is especially remarked during damp seasons, and is explained on the “chill theory”, according to which the nervous system, in endeavouring to adapt itself to the needs of the body, exposed to the great and violent changes of temperature said to occur during certain seasons in India, breaks down and becomes disorganised; that is to say, *kamri* is essentially a disease of the nervous system caused by exposure to climatic conditions. Chill is probably a wrong term to use, for the breakdown is nearly as often occasioned by exposure to excessive heat as to excessive cold; and considering that we know practically nothing of what occurs in the body when exposed to a temperature above its own, the theory cannot be summarily rejected. From a large number of observations made by the writer in these cases, it has seemed, first, that the changes of temperature in certain seasons are sudden and violent; and, secondly, that the connection between these variations of temperature and perhaps the malarious character of localities in which they are often observed is such as to lead to the conclusion that if not in themselves the cause of the disease, they undoubtedly have a most intimate connection with

it, and suggest precautionary measures in localities where kamri is most frequent. Much may, indeed, be done in all cases by avoiding exposure to the above-mentioned extreme variations of temperature, and by the maintenance of "tone" in the nervous system.

As a rule, most cases occur towards the close of the rainy season, and during the winter, only a few cases appearing in the hot months. Enzootic visitations are quite exceptional, and in none of these is fever-height indicative of a specific origin—in fact, one peculiarity of this disease is the absence of any febrile symptoms, the patients maintaining their appetite throughout and showing no signs of illness, save the peculiarity of gait noticed in these cases.

(2) Besides climatic conditions, there are also certain dietetic causes in operation which produce kamri both in horses and in men, and which have been proved sufficient to induce this disease when experimentally given to animals, or taken by human beings, as food. A variety of Indian pulse, which is found to be identical with the *Lathyrus Sativus*, and known as the kussari, kassar, tiura, tiuri, and latri, is fraudulently mixed with grain sold in the bazaars in India, and is a frequent cause of paralysis in horses when eaten in sufficiently large quantity to have effect. It is grown as a cold weather crop, and on land which will raise no other kind of pulse—chiefly on clayey soils, and on land submerged in the rainy season, and which hardens during the cold weather almost to the consistency of stone, and splits up into long, deep fissures. It occasionally grows in rice-fields whilst the rice stubble is still standing. Chemically it is exceptionally rich in nitrogenous constituents, and this may account for its tendency to produce paralysis.

(3) Surgical Conditions.—(a) *Reflex Kamri*.—Clinical observation teaches us that not merely motory impressions, but those also which cause sensations, may be reflected; so that the impression of one part is experienced by sensation in another. Impressions on the ultimate distribution of one nerve produce sensations in parts supplied by another nerve, or by another branch of the same nerve. Thus in shoulder lameness, due to disease of the liver, and in lameness behind, due to renal and cystic disease, calculi, etc., the sensations cannot be referred

to direct nervous communication, but to an influence reflected, probably from the spinal centre only.

In intestinal concretions, and in acute colic in the lower animals, we are familiar with lameness from pain reflected to the extremities.

Experimental facts show that there are reflex inhibitory centres in the cord. We are acquainted with nerves whose action consists in the inhibition of the action of other nerves; and so pathologists have been induced to look upon reflex paralysis and reflex inhibition as very similar processes.

(b) *Traumatic Kamri*.—Kamri is sometimes produced in its worst form from injury to the spine.

(4) Symptoms resembling those of ordinary kamri may be seen accompanying the course of certain specific diseases, but especially that of anthrax, rabies, surra, and others.

We may consider these *seriatim*:—

(a) We are familiar with a form of paralysis of the hinder quarters, which occurs in cases of rabies in the horse, but especially towards the latter stages of that malady; and this form of the disease simulates kamri in the horse when the history of the case is not known. Diagnosis is generally easy when we have the previous history of the case, and when other symptoms, absent in kamri, have been remarked in the case preceding the paralysis.

(b) Similarly, one form of anthrax, attended with paralysis of the hinder quarters, may be mistaken for kamri, but is distinguishable from it by (a) the course of the disease; (b) the concomitant symptoms of anthrax, which are never witnessed in kamri; and (c) the presence of the *bacillus anthracis* in the blood and other tissues of the patient.

(c) *Beri-Beri, Kákke*.—Dr. Wallace Taylor made the observation in 1880, that outbreaks of “beri-beri” in man were frequently associated with outbreaks of paralysis in animals—but especially in ponies and mules in Burmah, China and adjoining countries—and that this disease of animals had a pathological relation to that seen in human beings, in that the blood of affected animals showed, on examination,

the same organisms—*bacilli*—as Dr. Taylor had described in "beri-beri" of man. The subject of beri-beri has attracted considerable attention in India and elsewhere, and every day new and hitherto imperfectly understood diseases are coming under its nomenclature. Sir J. Fayrer even suggests that pernicious anæmia is probably the same disease in Europe. Cases of œdema of obscure origin, as well as other diseases so often met with in practice in India, might also be shown to be but different forms of beri-beri. One fact is noteworthy in Dr. Taylor's account, namely, change of situation and climate always brings about an improvement in these cases; and this fact has been noted also in animals, as Dr. Taylor mentions both an acute and a chronic form of paralysis, and it is the latter cases which benefit mostly by a change of situation.

(d) Veterinary Surgeon Steel noted in the Burmah outbreak, which he was deputed to investigate in 1884, that paralysis of the hinder quarters was remarked in many cases of that disease in mules; and he has since seen the same disease in animals at Poonah, where this symptom of paralysis was seldom absent.

Diagnosis.

I think the etiology of the disease shows that the subject of kamri in the horse—whether true or symptomatic kamri—is at once wide and interesting, and therefore worthy of our closest consideration. We must not, however, confound the simple forms of kamri with those due to specific causes, which are readily distinguishable by the course and concomitant symptoms, the presence of the specific organisms in the blood and other tissues, the influence of treatment, etc. The paraplegia accompanying the course of specific fevers—anthrax, rabies, surra, etc.—is not a *neurosis*, but is without doubt symptomatic, arising from reflex irritation of some remote disturbance, in this instance probably some blood-vascular derangement of congestive character. It is obvious that, the spinal cord being a complex organ, any reflex irritation arising from it would be more or less generally manifested, thus explaining the posterior paralysis sometimes noted in the course of these diseases. It is generally transient in character, of varying degrees of severity, and usually passes off on the disappearance of the other

symptoms common to the disease. The paralysis in kamri comes on quite independently of any febrile disturbance, and always runs a prolonged course, the symptoms lasting for many months or even years. In fact, general belief stamps the disease to be, as a rule, incurable through life: hence all animals affected with kamri, in the old stud days, were sold by public auction, as unfit for the service.

The specific fevers in which paralytic symptoms are noted, are contagious and enzootic, while kamri proper is not.

Symptoms.

A horse affected with kamri stands in the stall with his hind legs under him, *i. e.* places them somewhat forward under the belly and parallel to each other, instead of one leg before the other as in health. He changes his position now and then, and again stands as aforementioned. In backing, he does so with difficulty, and drags his hind legs under him, and, if any force is used, even goes down on his haunches sometimes. In trotting, he has a rolling action behind, and the hind legs swing from side to side, especially in going up or down hill, which is noticeable from the hips downwards. In turning at a trot on the left, the animal swings the off hind leg outwards, and the near hind leg when turning on the right side. Some severe cases have a difficulty in rising in the stall, and, except in cases of kamri from injury, they evince no pain on pressure to the loins.

These are the symptoms met with in ordinary kamri, and in 99 per cent. of the cases seen; the more acute symptoms of paralysis being referable chiefly to those of a specific origin, or to neglect of treatment in the early stages of the simple cases.

Prognosis.

I think that it may be stated generally that a person should not purchase a horse for at least twelve months after amelioration of the acute symptoms, and that he ought not to do so whilst any weakness in the animal's action is noticed, whatever time has elapsed since apparent recovery. The prognosis is more hopeful in young than in very old animals.

Treatment.

This should be both curative and preventive in kind. The treatment which is found most efficacious in practice is the internal administration of nux vomica, commencing with 20 grs. doses, and gradually increasing the amount to two drachms each dose, given twice daily till improvement is noticed. In some cases the iodide of potassium will be found beneficial, with iron and other tonics. It is always well to administer a physic previous to commencing the treatment by more specific agents. When symptoms simulating those of kamri proper follow in the course of any specific fever, the same treatment will be indicated as is found beneficial in the management of that particular fever; we must, in fact, treat the disease, and not the symptom in this instance.

Pathological Anatomy.

There are two kinds of changes of the cord principally, associated with cases of kamri: the atrophic and the hydræmic or œdematous, which may be found in varying degrees of severity in different cases, depending on the stage of the disease at which the *post mortem* examination is made.

The above changes are, doubtless, of secondary origin, the result of the disturbance of function, and afford no indication of the morbid influence by which the function is disturbed. The one almost solitary fact which we have to guide us in seeking for the seat of the disease is the change in the irritability of the motor nerves of the hinder quarters. This proves beyond a doubt that the nutrition of these nerves is changed. But such a change in the nerves suggests a similar change in the motor nerve-cells of the spinal cord. Of these the motor axis-cylinders are the processes, and share the changes in nutrition of the parent cell. Moreover, the loss of power, or paralysis itself, indicates that there is a morbid state of the grey matter, since we know that only nerve-cells can liberate the energy which causes motor power. We may feel sure, therefore, that the motor nerve-cells of the cord and the fibres proceeding from them, are in a morbid state. But here we must stop. Whether the morbid condition arises primarily in the cord, or descends from higher centres, we cannot tell; and opinions

which may be given, that this or that part of the brain is the seat of the disease, would belong, in the present state of our knowledge, to the region of unsupported theory. We are not justified in going for the seat of the disease beyond the spinal axis, including the grey matter of the pons and medulla, in which a morbid state is undoubtedly indicated. Of the nature of the change in the nerves and their centres we know almost nothing. The enduring alteration in function proves some change in their nutrition; but the fact that this change remains limited to weakened power, and frequently passes away entirely or becomes greatly improved under appropriate treatment, proves that it is comparatively slight in degree, and probably limited to such fine molecular changes as could not be recognised by any means of investigation at present at our disposal. The functional alteration in the motor nerves is at present the only pathological indication we possess. But functional disturbance in the nervous system often indicates vaso-motor disturbance. The vaso-motor symptoms, therefore, that are now and then witnessed in some cases, are clearly secondary in time; and we are not justified in assuming that they are in any way a special feature of the disease. So also the leucocytal aggregation about the vessels, engorgement of them, etc., which have been noted in a few severe cases, are slight and variable traces of similar disturbances in the spinal cord.



CHIBER.—SYN.: PEMPHIGUS (BURKE), SPECIFIC ECZEMA (FRÖHNER U. FRIEDBERGER), "MAUKE" (GERMAN).

THE ancients, as well as many mediæval *hakeems* and *baid*s of various denominations in India, attributed this malady to some great perturbation of the system, some general change, whereof "chiber" is but a local manifestation. The subject has often been handled by veterinary surgeons in India, but nothing definite regarding it has ever been suggested; and such names as herpes, mange, grease, etc., indicate the nature of views held in regard to its pathology.

Many believe that it is entirely a local disease, but some authorities contend that a disease having a tendency to run a chronic course in so many cases, cannot be considered local in character, and must therefore be classed among the general diseases.

My view of the subject is that the variation in the stages of the disease itself, is some excuse for the variety of opinion as to its pathology which obtains in the profession in India.

The disease prevails especially in the rains, and during the winter months, when heavy dews fall, which bathe the animal's legs when turned to grass. Pretty extensive inquiries made in various parts of the country have failed to show the existence of the disease during other seasons or in dry weather.

As to the nature of the morbid changes, the most reasonable view seems to be that it is the result of an organic poison, or micro-organism, entering the tissues through chinks in the epidermis, which spends its local action on the neighbouring structures, without ever producing any constitutional symptoms. As there is nothing else to account for the production of these cases, the condition of the grounds over which the horses have been exercised or let loose seems the most natural source to look to, and, as mentioned above, the dew and moisture about the roots of the grass, perhaps containing the organisms in question, have been shown to produce this disease in many cases, which leaves not the shadow of a doubt as to its mode of origin.

Friedberger has observed that on account of the wet and cold, this disease especially prevails during the winter in Germany. Prietsche* has found that this disease prevails also as a result of sprinkling salt on the tramway lines during winter months. Straub† has recorded the occurrence of "traumatic eczema" in these parts liable to chiber, noticed in army horses which were exercised over recently-cut fields, which resembled more a form of infectious inflammation of the skin than simple eczema. This form of disease resembled somewhat the ordinary "mauke" described by the Germans, and was characterised by a great number of small ulcers on the skin, which were followed, in aggravated cases, by erysipelas and phlegmonous inflammation of the skin. This infectious dermatitis does not, whether in the German or Indian forms of the disease, occur as a rule, except when the eruptions burst, or cracks occur in the skin from accidental causes, allowing access to septic matters.

Röll,‡ Friedberger u. Fröhner, Anacker, and others describe this disease under the name of "mauke," which they consider to be a form of *specific eczema*. They notice that the practice of cutting the tuft of hairs from the back of the fetlocks in coarse-bred horses, observed in European countries, especially deprives natural protection of the parts, and frequently leads to this disease. "The long dewy grass perpetually brushing against the coronets when the horses walk, would, of course, wet the front more than the back of the foot, and the evaporation, by producing a reaction, might bring on inflammation of the skin and other symptoms of the disease" (Meyrick). "The hind feet, being more exposed to the irritating action of damp, filthy standings, are generally more subject to this disease" (Friedberger). Veterinary surgeons in charge of the Central Government Studs in India observed the same fact.

The disease appears chiefly, in India, in horses brought in from damp fields, and their legs allowed to remain wet for long intervals, or imperfectly rubbed dry from neglect or carelessness on the part of

* Sächs. Jahresbericht, 1884.

† Repertorium der Thierheilkunde, 1853, p. 213.

‡ Lehrbuch der Pathologie u. Therapie der Hausthiere, 1885.

syces. Simply rubbing the legs dry does not prevent the disease: they should be thoroughly washed before rubbing them dry with a cloth. Washing in stagnant rain water, obtained from ditches along roadsides, also produces this disease.

Etiology.

The disease may be defined as a special form of *neurosis** of the blood-vessels of the skin, attended by loss of tone and more or less inflammatory disturbance, followed by exudation of serum, which infiltrates the structures of the skin, and raises the epidermis in blisters. The blisters contain at first simple serum, which, later on, becomes purulent, or sero-purulent in character, containing pus cells, probably due to migration of white blood-cells and proliferation of the rete. Bacteria sometimes, though not constantly, appear in the contents of the vesicles. The blisters finally burst, and a watery-yellow, at first odourless liquid, finally becoming purulent or sero-purulent in character, flows (*stadium madidans*). The swollen skin, by the movement of its thick folds from effusion, cracks during the animal's progression, and contractions set in. The cracks in many cases take on inflammatory action, and in a short time again become covered by a scab, causing a matting together of the hairs and depilation. In some cases a peculiar fluid oozes from the affected skin, drying up into thin, varnish-like crusts. The surface becomes, after a time, covered with hairless skin, so hard and dense that it resembles frog-horn (*Pemphigus folicaceus*). The disease then assumes an entirely new aspect.

"During its later stages," say Professors Friedberger u. Fröhner, "a peculiar running from the surface of the skin may be noticed, which bathes the epidermis. As a consequence of this, we find a colourless, adhesive substance, accompanied by fœtor, completely covering the affected skin, and which, finding access through the cracks, causes chronic thickening of the skin."—(*Lehrbuch der Speciellen Pathologie und Therapie der Hausthiere*, 1886).

Varieties.

It is not necessary to recognise more than two forms, acute and chronic chiber; whilst a multitude of other names, from their

* Heath's "Dictionary of Surgery," art. Pemphigus.

pretty constant appearance, may be mentioned as sub-varieties of one and the same affection. The acute form is associated with an outbreak of larger or smaller vesicles, which die away without giving rise to any other changes of the skin or subcutaneous tissues to be met with in the chronic variety (*pompholyx*), in which the process gradually extends until the greater part or whole of the skin and subcutaneous tissues becomes implicated. Cracks then appear on the surface, the hair falls off, and a nauseous odour exhales from the affected skin. The vesicles appear in successive crops, and horses that have once suffered are not exempt from it afterwards. Professor Friedberger says in rare instances the affected skin has been seen in time to assume the characters of elephantiasis, but this is only seen in bad or protracted cases, and is not characteristic of the disease itself.

The acute variety (*Pemphigus acutus*) and the chronic (*Pemphigus vulgaris*) are the most common forms assumed by both chiber and its German type, "mauke."

Itching is very marked in many cases, which is evidenced by the horse stamping his feet and rubbing them against each other, the animal frequently breaking the vesicles with his teeth, as well as by friction of the opposite leg, as soon as they are formed (*Pemphigus pruriginosus*). Hence the vesicles are not often seen which have formed and recently broken: the epithelium is found ruptured and gathered into folds. In the pruriginous form the vesicles are smaller than in the other varieties. Some authors on human medicine describe this type under the head of "pemphigoid."*

Attempts made to communicate chiber from one horse to another, by inserting the contents of the blisters under the skin of the coronet and pastern, have failed to produce any results, save a soreness of the skin, which passes off in a couple of days. The disease is, therefore, not contagious.

Treatment.

The treatment will vary according to the stage of the disease. In the beginning cleanliness and dryness, combined with dressings of oxide of zinc powder or of zinc ointment, will suffice to

* "Skin Diseases," by Dr. T. Fox, 3rd ed., p. 220, 221.

effect a cure. In more advanced stages of the disease, more energetic means will be necessary, principally astringents and caustics, to cause it to subside; alum, borax, catechu, charcoal, nitrate of silver, etc., are the agents most commonly employed, and are generally attended by good results. Iodoform has been recommended by many German veterinary surgeons, but when once induration and hypertrophy have set in, no treatment is generally of any avail.

In Quain's "Dictionary of Medicine" Hutchinson* is quoted, who thinks arsenic is the only remedy of *certain* value in bad cases of pemphigus in the human subject. Mr. Meyrick, in his *Stable Management and the Prevention of Disease among Horses in India*, says,—“The internal administration of arsenic in five-grain doses for about a fortnight seems to assist the cure in bad or protracted cases of chiber.” The natives of India have employed arsenic in the treatment of chiber from the earliest times, and they believe it is a specific for some forms of this disease. Perhaps arsenic in large doses does good by acting as a diuretic, which relieves hyperæmia of the skin. The *foliaceous* variety is best treated with repeated blisters of hydrarg. rubrum.

Diagnosis.

The only diseases with which chiber is at all likely to be confounded are herpes and variola, both of which always run a more rapid course than it, and are therefore quite distinct. We have no such thing as protracted vesicular eruptions in herpes and variola, which diseases having once appeared do not show themselves again, or persist like chiber frequently does. In the acute form of chiber the vesicles burst almost as soon as they are formed, so that they often escape detection; in herpes the vesicles do not rupture as a rule, but their contents, after becoming opaque, disappear by *resorption*,† and only rarely by rupture and desiccation into light brownish scabs. In the majority of cases the vesicles in herpes last about eight days, in chiber they burst as a rule as soon as they are formed, or very soon afterwards, and frequently escape detection.

* See a detailed examination of the facts in Hutchinson's "Clinical Lectures," vol. i., 1879, pp. 49-74.

† "Skin Diseases," by Dr. Tilbury Fox. 3rd ed. art. Herpes.

Contagious impetigo in the horse, observed by Schindelka* and myself† is characterised by special features, and could hardly be mistaken for chiber. The disease is, moreover, contagious, and chiber is not.

From eczema the history usually distinguishes it, the lesion getting no better for many weeks; eczema, on the contrary, is either cured or spreads very quickly. Some veterinarians who have witnessed this disease in its acute form only, deny this, and consider chiber terminates with the rupture of the vesicles, whilst they attribute the chronic changes to neglect of treatment. It is, under any circumstances, a most important subject for inquiry.

* Oesterr. Vierteljahrsschrift f. Wissenschaft. Veterinarkunde, 1883, page 61.

† Annual Veterinary Report, 1883. The Veterinarian, Oct., 1886.

"BARSATI," OR ATROPHIC CARCINOMA.

From 1838 to 1851 numerous essays, papers, and other contributions were published on this subject of *Barsati*, especially those which came from the pens of Army veterinarians serving at that time in India; and numerous were the theories then propounded as to its nature. It was not until 1873, however, that Spooner Hart, of Calcutta, an enthusiastic veterinarian and accurate observer, published his essay in a series of excellent papers contributed to *The Veterinarian*, far in advance of all preceding descriptions, and possessing that touch of critical appreciation which alone distinguishes a practical surgeon and clinical observer. But in recent years the opinion has been gradually coming into prominence that the clinical characteristics of disease have not the value as an element of inquiry which many would assign to them; that they are not, singly, the be-all and end-all of our pathological problems. Clinical knowledge, whether viewed as an art or a profession, should ever be agreeably associated with the other departments that are interesting in science and pleasurable in inquiry.

So much has already been written by way of contribution to our knowledge of this disease that, important as the subject is, it may be considered to have received already a fair share of attention; the pathology of it, however, cannot, perhaps, be dwelt upon too much, if we would stimulate a practical inquiry into its causation and treatment.

It is not necessary to remark that my observations led me to state as early as 1880* that this disease was cancer of the horse; and I believe no other writer has preceded me in this conclusion, so far as my knowledge of its literature has shown.

These observations refer to a few additional branches of inquiry set forth here, and I believe they may not be devoid of interest as supplying a continuation of the history of the disease; while, at the same time, it will be of some importance on account of its nomenclature and pathology, Barsati being confounded in India with many other diseases, some of which are sufficiently characteristic, while others may

*Veterinary Journal, 1880.

be said to possess only a casual resemblance to it. It is therefore necessary to have as clear a view of the disease under consideration as possible, which can only be obtained by comparing its characteristics as they occurred to various observers in separate localities, in different years and seasons, and under varied conditions of climate and treatment. Barsati flourishes in the low-lying parts of India where heat and moisture are combined. It is seldom or never heard of on the hills or in dry, elevated localities. Mr. Oliphant has recently observed that taking horses, the subject of Barsati, to the hills, brings about a speedy improvement. And the Collective Investigation Committee in England, have been lately engaged in an inquiry into the relative prevalence of human cancer, which so far establishes a similar explanation in regard to geographical and hygrometric distribution. Dr. Henry Butlin* writes, that "High and dry localities are unfavourable to the occurrence of cancer, and that the disease flourishes chiefly in low, flat parts of the country" (England), "which are covered by alluvium, and watered by many streams that are subject to frequent floods."

Dr. Walshe † writes: "Certain regions of the globe are peculiarly exempt from the ravages of cancer. But is this exemption to be really referred to the special influence of climate or to some concomitant condition?" Dr. Lyford, ‡ of America, writing on Barsati, remarks: "It seems to be confined to the neighbourhood of Minneapolis and St. Paul, with the exception of a few cases, which migrate each year. Under these circumstances the question naturally arises, Why should this disease appear in two localities so far distant from each other as India and Minnesota, and under such different circumstances, and without the least sign of the disease in any of the intermediate localities?"

Jessett ¶ says "Cancer is more rife in *low-lying damp situations*" where cancer is more prevalent in England, such as we have found in this country, and Dr. Lyford has noted in America. Much stress has, from the first, been laid on the effects of wet weather, because it was

*Brit. Med. Journal, July 11, 1885, p. 53.

†Treatise on Cancer, by R. Mitchell, 1879.

‡Veterinary Journal, May, 1886, pp. 379-81.

¶Brit. Med. Journal, April 26, 1884.

observed that almost all the cases of Barsati were aggravated during the rains. In spite of the stress laid on this point, it was shown by the records of the late Bengal Studs that by far the largest number of cases of Barsati was actually admitted for treatment long before the commencement of the rainy season,* and the months of March, April, and May are mentioned as showing the largest percentage of admissions.

A wet climate may predispose to the disease by enfeebling the animal's constitution, so that the tissues are rendered deficient in tone and nutritive functions by the sudden excess of moisture in the atmosphere, and by its direct injurious action on the local tissues, as seen in many forms of skin disease. Cutaneous disorders of a somewhat obstinate and chronic character are always found prevalent during the wet weather from hyperaction of the skin, and which no amount of local treatment will generally remove. It has been observed that heat and moisture are favourable to the growth of vegetable fungi, which are the cause of Barsati sores becoming aggravated during the rains. If this be a sufficient explanation, how does it happen that simple sores are similarly aggravated during wet weather in India? The notion of parasitic action is contradicted positively by the fact of wet weather proving hurtful alike to Barsati as well as to all simple sores.

Here, then, we perceive the opening of a most interesting and fruitful line of pathological inquiry, not yet ever seriously attempted, namely, the deleterious effects of heat and moisture upon newly injured tissues.

Pathology.

I have in the past brought forward facts, both clinical and pathological, to show the relationship that exists between human cancer and Barsati in all the main features. These facts, while they might serve to prove that fungi exist in sores exposed to the air, are wholly opposed to the idea that the peculiar cell changes occurring in this disease are necessarily caused by such fungi. Indeed, to imagine that fungi met with in sores once exposed to the action of the air would explain

*The rains do not begin till the latter part of June, and end in September. The term Barsati is, therefore, a misnomer.

the morbid changes, must be regarded as rather sanguine. There is nothing in the history of the disease, nor in the results of its treatment, to show that its cause is likely to be parasitic. Experiments by Professor Uskoff, of Cronstadt, on dogs, show that marked necrotic changes in tissues in many cases are unattended by the appearance of organisms in even the smallest number, and have therefore led to the conclusion that the universal dependance of structural changes on parasitic organisms, maintained by some persons, is incorrect. The appearance of organisms in some cases he ascribes to the possibly imperfect removal of them from the liquids used, or to the circumstance that, by their mechanical injury to the tissues, the power of resistance was lowered, which allowed the growth of the organisms. It will thus be seen that his investigations entirely support the position maintained by several of the foremost pathologists of the day. Drs. Lewis and Cunningham, of Calcutta, have already shown how, similarly, the growth of fungi in Delhi-boil may occur as the result of the tissues being steeped in chromic acid and chromate of potash solutions. Quite recently Dr. Fenwick* has found that in tissues hardened in a four per cent. solution, of cocain, a peculiar mould fungus always develops, whose presence is accidental and due entirely to the process of hardening the tissue. Parasitic organisms frequently develop also in specimens stained in carmine solution.†

Warden and Waddell‡ have recently experimented with the Arbus poison. Hypodermic injections were made, mainly on cats and fowls, in order to determine whether a general parasitic condition was necessarily associated with the toxic action of the seeds. From the general results of their experiments the authors conclude that the presence of organisms at the seat of injection is purely accidental, and that these develop from the air after the injection. Professor Ponfick¶ has demonstrated that organisms of various kinds are always present in tissues after the injection of turpentine and some other chemical irritants.

*Lancet, 1885.

†Brit. Med. Journ., July 18, 1885.

‡'The Non-parasitic Nature of Arbus Poison,' by C. H. Warden and L. A. Waddell, M. B., Calcutta, 1884.

¶Virchow's Archiv., 1881.

We cannot directly prove that parasites here precede the disease changes; indeed, all experience teaches the reverse; yet from theoretical reasoning we must conclude that such must be the case. But it seems to me that the proofs of clinical experience are of even greater consequence than any theoretical conclusions. If the parasites were the cause the disease would be communicable by inoculation. Yet, experiment has long decided in favour of the non-communicable nature of the disease. Those who favour the view that Barsati is of a parasitic origin, give us no proof in support of their view, which, to some extent, converts the morbid process into a sort of skin "sepsis," and contagious would thus differ from simple disease only in degree; since all local virulent action is absent in this disease, how can we distinguish between a simple and "infective" form of disease? May the one at any time become the other, and, if so, in obedience to what law? Those who support the "fungus" origin of Barsati leave this matter very much an open question, as indeed was unavoidable, for we do not know enough about the other varieties of this disease. It is remarkable that a series of inoculation experiments—scarifications and hypodermic and intravenous injections—conducted by myself as well as by other veterinary-surgeons should have been followed by no results, either local or constitutional. Indeed, judged by the verdict of common experience, the disease cannot be communicated, and is therefore not contagious.

If the analogy of parasitic action holds good between cancer of man and Barsati in the horse, we must assume that in every instance the disease has been "caught." But experience proves this to be correct in respect of neither. Thus, Dr. Wilks says, "Cancer cannot be inoculated; it does not run a definite course; and, indeed, has no qualities which deserve it to be considered as foreign to the organism of the body," and all attempts hitherto made to communicate Barsati to healthy animals have been attended by similar failures. Neither the human nor the equine form of the disease can be inoculated. I lay stress on this point, as I find observers on both sides pointing to exceptional cases of success attending their inoculation experiments. It is possible that there may exist an actual diseased state of system not yet developed, and where by local irritation in the attempt to inoculate with the discharge a nidus

may be formed for the actual development of the disease, but then only as any other local irritant. Besides, as Dr. Tilbury Fox has observed, connective-tissue corpuscles, when altered by disease, have this power of communicating disease most markedly developed.

A large number of experiments have been made by me during the last two years on horses, ponies, and dogs, with fresh matter from Barsati growths, and no results were produced. Allowing, therefore, for the sake of argument, that Mr. Smith has found a new method of injection, which produces Barsati growths in healthy animals, does this prove that the parasites he has described are the cause of Barsati growths? Do we not know of connective tissue corpuscles, as altered in disease, producing degenerative changes in the tissues, and even leading in many cases to fatal results, as shown by Virchow, Dr. Tilbury Fox, and many other good authorities? Do we not know of similar corpuscles detected by Dr. Flemming in Delhi-Boil, and which were also inoculable, producing sores in many instances indistinguishable from Delhi-sores? The production of pus-cells from pressure, of granulation-cells due to altered nutrition, &c., show that cell changes are not always connected with parasitic action, but may be independent of it. We have detected several species of bacillus, vibria, and micrococcus in the scrapings from ordinary ulcers in India.

Given the extensive changes of the skin and subcutaneous connective-tissue from long-standing ulceration in Barsati, and the surgeon has no difficulty in explaining a recrudescence of disease and its return in tissues originally attacked, by a process of cell-degeneracy, independently of the existence of fungi. The teachings of Huxley, Virchow, Uskoff, and others show that the theory of susceptibility and phlogogenous action of cell upon cell is not all nonsense; it is only out of fashion, because many, at the present time, know of no "infective" process other than that by germs and fungi. Dr. Wilks writes, "It is now known that a variety of morbid growths may be produced in the tissues, and that between the one which is styled cancer and that which is identical with healthy material, all grades may exist. They are but modifications of normal tissues, show only altered nutrition, and can by no means be regarded as foreign to the system." Health and disease are in the main

easily distinguishable; but as we approach the frontier, so to speak, of either condition, the power of defining between what belongs to health and what to disease, becomes more and more difficult, the one apparently leading into the other through such an insensible series of gradations that it is impossible, as Professor Huxley holds, to say at any stage of the process—Here the line between health and disease must be drawn. On this view, false growths like Barsati and other tumours, are merely abnormal developments of normal growths.

Can we infer from the casual relationship of parasites with Barsati sores, that the former are necessarily the cause of the latter? With the facts recorded in the past regarding Barsati, it behoves both scientists and practitioners to look to their diagnosis, to improve if possible our knowledge of the clinical history of the disease, so that its application to pathology should become both wider and more precise, for the precision of our results in practice must depend upon the perfection of our diagnosis. If the diagnosis of so serious a disease is to be arrived at by the arbitrary adoption of a single symptom, the presence of a vegetable fungus, the marvellous success of treatment in the hands of some practitioners, as compared with others, may be explained. While fully admitting the importance of a search after parasites as an aid to diagnosis, we fancy that on this, as on many other methods of research, too exclusive dependence should not be placed, as it is probable that fungi may develop under different disease-conditions, and under more circumstances than we at present suspect. That parasites should be found in many sores in India we readily grant, but we altogether dissent from the view of their being the cause of those sores.

In the case of certain cutaneous diseases in which organisms have been found, the latter appear to have the necessary connection with the diseased conditions, but such connection is wanting in the affection here referred to, viz., Barsati. We are not among those who reject all the vegetable theories of specific morbid processes. But the evidence in favour of the parasitic origin of Barsati, as well as of some other forms of sores met with in India, is not so strong as that concerning other diseases known to depend upon the growth and action of fungi. Drs.

Smith and Flemming* previously maintained that fungi were seen in Delhi-boil; and Drs. T. Lewis and D. D. Cunningham,† have since shown that the development of these fungi in Delhi sores was due to the methods of preparing the specimen for microscopie examination, and may be seen in *healthy* tissues hardened in special media. And if the existence of the fungus is possible and frequent apart from a Barsati sore, why, it may be asked, is it likely that it is in any way a cause of it? It would be a begging of the whole question to infer that, because certain fungi grow and develop in Barsati sores, there is, therefore, evidence of cause and effect between the fungus and Barsati sore, and that the study of the disease has become superfluous.

It appears to me incorrect, therefore, to refer this disease to parasitic action, as has hitherto been traditionally done, at least so long as we have not more definite clinical and pathological proofs than those we at present possess. Any change in the nomenclature of disease which is made without due consideration of facts of clinical medicine and pathology must surely hinder accuracy in diagnosis, and is therefore to be deprecated. Uskoff, Ponfick, Dr. Burdon Sanderson, Beale, Bennett, and others many years ago rejected an exclusively vegetable theory of morbid processes, which has not been controverted, and the idea of many normal cells capable of modification into the various forms of disease producing particles, commends itself at once as a view likely to reconcile many differences, and be acceptable to practical as well as inductive physiologists, pathologists, and clinicians.

Paget says: "From numerous observations made during the last few years it would appear that the characteristic cancer cells and nuclei may, like the corpuscles of pus, take their rise from pre-existing cells and nuclei of the texture or organ in which the new growth originates." This mode of origin of the structural elements of cancer was first pointed out by Virchow, and he has more particularly directed attention to the changes which take place in the connective tissues during the development and growth of cancer in it. Paget writes: "For the present I will only say that I think malignant tumours are local manifestations of

* Army Medical Reports, 1868-69.

† Report on 'Oriental-Sore,' or Lupus Endemicus, 1876.

some specific morbid states of the blood, and that in them are incorporated peculiar morbid materials which accumulate in the blood, and which their growth may tend to increase."

"The anatomical elements of cancer are now known to have no special and peculiar characteristics, and they are believed to be as easily derivable from pre-existing tissues as are other non-specific morbid growths. Most physiologists, especially on the continent of Europe, now maintain that every structure, new or old, is formed by the proliferation of the pre-existing cells. Anatomists have also done much to shake the fixedness of our methods of healing by finding evidence to show that what appear superficially different forms of morbid products are, in reality, different grades."

Many observers agree in stating that Barsati sores are very liable to be immediately developed in the seats of abrasions, and that small sores take on in India a fungous or ulcerative character like Barsati sores. Mr. Hart speaks of this as occurring commonly during the rains in connection with the wounds and galls of the horse. Mr. Armstrong notices the same thing. And we have only recently recorded several similar instances—which would not show a parasitic origin in respect of this disease. There can be little question that disorder of the general nutrition induced by climate is one element in the production of Barsati and its allies. The parts attacked are those most exposed to injuries or irritation: *example*, angles of the mouth, the lachrymal region, the prepuce, inner aspect of the fetlocks, &c. And we are not without analogical evidence of similar disease being induced in like manner in other species, and in some other countries. French medical literature abounds in instances of such tissue changes being the results of climatic influences. In the West Indies, in China, and in some other countries, it has been observed that sores take on not a suppurative or ulcerative action, though they do this sometimes, but frequently are succeeded by an hypertrophous growth of the fibrous tissue as the result of such influences. It is clearly shown by these results, therefore, that the causes which have been supposed to engender them are not such as can, in any intelligible way, favour the introduction of germs

from without the body. Thus, in this disease, the continued irritation of tears over the lachrymal surface, or of secretions within the prepuce, or of the bit against the angles of the mouth of the horse, has been observed to be followed by the occurrence of Barsati in these parts in such a number of cases as to justify the inference that it has been the starting point of the disease. Such growths arise, then, from a peculiar perversion of the normal nutritive process, allied to those modifications which we have been induced to suppose are the causes of the more peculiar kinds of common growths; but in the case of malignant growths, the perversion is much greater in degree, and shows itself not only in its origin, but in its whole subsequent history. The irritations connected with the bit at the angles of the mouth, with the secretions in the prepuce, and the habit of "brushing" at the fetlocks, &c., may induce this extraordinary alteration in the molecular nutrition of these parts, leading to the disease under consideration. We have had several times the opportunity of examining portions of skin affected with Barsati in the earliest stages, and the anatomical changes present in them have been uniform and simple. There is an area of increased vascularity, over which a dense infiltration with small cells is seen, placed just beneath the epithelium. The latter is thickened and piled up in disorderly fashion. The cells of the rete are undergoing rapid multiplication, the lower layers being crowded, and in places heaped up in masses or little *balls* which, often attaining to a large size readily visible to the naked eye, undergo calcareous deposition, and acquire a hardness which has likened them to the stone known in India under the name *kanker*. Thus the whole process of normal formation of the skin is at a disturbance. Whether the excitant which causes the disturbance is engendered by chronic irritation of the part, or whether it is only rendered locally active by it under certain constitutional* conditions are questions which remain at present unsolved in pathology. But

*The significance of desquamation following the administration or use of certain drugs, such as turpentine, perhaps capaiba, &c., have a good deal to teach yet about the law under which cell changes take place locally, as a result of constitutional causes.

the degree of evolution to which a new formation may attain, must plainly depend, to a large extent upon the nature of the excitant. The more it resembles the normal stimulus to growth and development, the more perfect and limited will be the development of the new growth; and the more intense the excitant, the more embryonic and unlimited the growth.

Those who are contending for a proof of the parasitic theory of this disease, seem to be driven to the choice of one alternative—Is it, or is it not communicable? Mr. Smith alone has succeeded,* after experiencing many failures,† in inoculating Barsati from one animal the subject of it to another that was not. And if we review the general experience in regard to experiments in this direction concerning both cancer of man and as it occurs in the horse, we find that the results of such experience differ in respect of neither. An experiment of Professor Langenbeck was supposed to have proved that the cancerous pulp containing the cancer cells is capable of propagating cancer in man and animals on being injected into the veins, but the attempt has been frequently made by others without any result. So in regard to Barsati; excepting the above instance, all other experiments by other veterinary surgeons have uniformly failed to produce the disease, although enough experiments have now been made in this direction.

The fact that the disease can be induced by inoculation, moreover, does not prove that the cause of the disease is derived from without the body, since the very cells of the body themselves, as changed in disease, can be transplanted from body to body and induce furunculoid and ulcerative mischief; in other words, there is nothing in the aspect of the disease itself, nor in the facts of the inoculated disease, to show that its cause is very likely to be parasitic. A direct transmission of Barsati has been proved impossible; and it by no means follows that one or two exceptional successes which are recorded were entirely due to the inoculations, and were not developed in the ordinary course

*Veterinary Journal, 1884.

†Ibid, 1879, 1881.

of things, seeing that simple wounds in India so often terminate in Barsati. I do not wish to say anything in discouragement of experiments, seeing that I have probably tried inoculations on as many animals myself; but individual results should include general results. It is also probable that constitutional predisposition, as from previous attacks of the disease, when present, may favour the success of an inoculation. We must at present explain differently the connection between such successes and the causation of the disease under consideration. We, at any rate, know that the accumulated experience of veterinarians of thirty odd years shows that experiment in this direction is by no means isolated; but is one of a series, many of which have been published in the pages of our professional journals. We may study Mr. Smith's success from two points of view, as showing the influence of constitutional tendency upon local disease processes, and the influence of local irritation upon general constitutional states. It is known that in a very large number of cases where simple wounds have been seen to be followed by Barsati sores; the constitution of the animal was at fault; as shown by the history of many cases. Although the actually demonstrable lesions of this disease appear to travel from local to systemic centres, there is yet every reasonable probability that constitutional tendency, especially if favoured by climatic causes, may be the starting point of genuine Barsati. The local manifestations may be regarded as expressions of a general dyscrasia; and an animal which from an injury or irritation gets indubitable Barsati may be held to be predisposed from causes latent in the system, which may appear healthy or even produce such results on the body as may be designated for the time "robust."

Thus far we have justified the contention, I think, that the disease originates by means of primary changes in the skin of necrotic character; and although the "fungus" theory has long been in high favour with some writers, there is an abundance of valuable and fruitful work to be done before these questions can be definitely settled, the disease having at one time or another, been mistaken for most, if not all of the chronic ulcers and sores of India, including Delhi-Boil, Keloid, Rodent ulcer and Ichthyosis of the horse. We have no idea how

common it is, at first sight, to mistake any of the above mentioned diseases for Barsati, and how necessary it is, in dealing with any disease, to recognise and watch the clinical differences that are presented. The secondary changes in internal organs we have recorded in many cases of long-standing Barsati are due to proliferation and malnutrition of the parts concerned, and necrotic changes locally taking place, owing to the discharge of necrotic tissue into the circulation. This *metastasis* never manifests itself early in the course of the disease, but shows itself only after a long interval, as proved by numerous autopsies we have now made.

Not a few cases of Barsati become, after a shorter or longer time, arrested and retrogressive, and, ultimately, to all appearances, cured. These apparent cures are not always permanent, but after intervals of six months, a year, or more, a similar affection is started again, either in the same or in another part, or in both, when it contaminates the internal organs, or becomes again *atrophic* and is arrested: another striking resemblance between it and the form of human cancer known on the continent of Europe under the name *Atrophic Carcinoma*. Some pathologists call this *Recurrent *Fibroid*, a vague term applied to many different species. For a tumour to be called fibroid it is not enough that it should contain fibrous tissue; it must also contain no other tissue. A fibrous matrix is common to nearly all tumours; and Barsati has a fibrous stroma which predominates in many parts of its structure, but it always contains in its mesh-work cells; whereas true fibroids are composed solely of fibrous tissue. Moreover, although the distinctions of the various forms of cancer are useful and wise, and practical, and founded on natural laws, still there are cases in which these different forms pass into each other, and in which all these peculiarities may be seen affecting the same patient. "These cases of combination" says a recent writer on cancer, "are sufficiently rare to make the distinctions valuable in practice, but they at the same time show the common character of all these forms of disease." Various other names have been given to this form of cancer, as for example, *contracting cancer*, *cicatricial cancer*, &c., each of which indicates some prominent feature of the disease. The cells, in this form of the disease

*The term "recurrent" here is misleading, inasmuch as all malignant growths are recurrent.

appear to be very short-lived, for they are scarcely formed before they commence to decay (*Billroth*); but peripherally the slight cell-infiltration constantly extends; hence complete disappearance of the disease very rarely, if ever, takes place. Some surgeons even object to the term cancer being applied to epithelioma, but this objection is not valid, being founded on mere physical differences of no importance.

Mr. Hart writes—“After an *indefinite* period of immunity the disease (Barsati) reappears.” We know the history of several cases in which the disease recurred after a cessation of three years, and in one case, recently treated, after a period of four years, whilst *Hutchinson*, Professors *Billroth*, *Buchanan*, and Dr. *Whitehead* give instances of immunity after operation and other modes of treatment for cancer, extending to three, five, and fifteen years in the case of man.* The tendency to fibroid development in excess of cell formation is one of the most potent agencies in giving respite, and, in some cases, towards arrest and apparent cure of the disease.

Clinical Characteristics.

The relation of Barsati to cancer of man has presented great interest since our first announcement on the subject, and if the identity was not before actually suspected, the clinical observations and experiments which appear in the past literature of the disease clearly point in this direction, and which establish the identity contended by me beyond cavil or dispute. There are included in the facts given, reasons which, not refuted by the parasitic theory, require separate and permanent recognition.

We must now examine the several clinical features of Barsati and human cancer, and see if we can find that any of them show marked and definite relations to each other. I give quotations of the disease as seen in the two different species, for it is necessary to form a judgment as to the relative characters of each and to have a wide overlook on experiences which have been in the past recorded. My opinion is, and it is founded on careful investigations of many years, during which time I have witnessed the disease in its most varied and pronounced aspects, that

* *Lancet*, October 29, 1881.

Barsati is a disease common to robust condition of body, and that, although appearing in all animals, it is most frequently seen in horses having reputed good condition of body, the health only suffering in proportion to the advance of the disease from local parts to the internal organs. I believe the recorded experience of other veterinary surgeons shows this conclusively. And the experience of surgeons regarding cancer in man is, that, "prior to, and for a long time after the appearance of a cancerous sore, the constitution is distinguished, in most cases, by its remarkably healthy characters, and by the absence of any appearances which would indicate disease."* The great question which is thus raised is as to the condition of patients previous to the appearance of this disease, and the general answer is, "Remarkably healthy." Mr. Smith† characterises the condition of horses subject to Barsati as "vigorous."

Most authors who have written on cancer state that simple wounds and ulcers sometimes become the seat of cancerous disease, and that the epithelial form of cancer does frequently arise in the chronic ulcers themselves. Now, what is the experience in regard to Barsati? I shall quote Mr. Hart,‡ who writes, "Simple sores and galls, if neglected, are very apt to assume *bursattic* action"; which is the general experience of veterinary surgeons in India. Writers on cancer lay great stress on "induration of the sore" as especially distinguishing cancer, a fact emphasised by those who have seen anything of Barsati before writing upon it. I. V. S. Oliphant;¶ in charge of Hapur Stud, observes: "From rubbing or biting—for the sore is particularly itchy—the crown of the ulcer becomes violently detached, leaving a moist, irritable sore, *the base of which speedily becomes indurated*." Mr. Hart, in his paper on Barsati, describes "an indurated base extending to a depth of half an inch or an inch." Another important feature of Barsati, is the presence in the sores of pain or irritation felt at different intervals. Mr. Hart writes, what must be in the experience of every one, that, "Barsati sites, though healed, are liable at any time to become irritable and to be

*Treatise on Cancer, by R. Mitchell, 1879.

†Veterinary Journal, 1881. p. 308.

‡Veterinarian, 1873, p. 17.

¶Veterinary Journal, July, 1880, p. 8.

gnawed by the horse; this fact showing beyond dispute that some irritative action is going on." This pain is certainly considered very characteristic also of human cancer, although it is not constant, or the patient could not live, but comes on at intervals only.

A fact of some importance in the clinical history of Barsati is, absence of inflammation characterising the sores. I. V. S. Weyrick, in a lecture delivered at the Aldershot Military Veterinary School in 1881, said, the disease was "non-inflammatory" in its character; and John Hunter, in 1828, wrote, "True suppuration arises from inflammation, terminating in a disposition to heal, which is not the case with cancer." The sore in Barsati in the early stage is, moreover, usually single, as in cancer, rarely becoming multiple until a late stage, and seldom even then; while the sores in parasitic disease are mostly multiple. The points of junction of skin with mucous membrane, as well as parts exposed to friction, are most frequent sites of Barsati ulceration. Hence the favourite seats of Barsati are seen to be the angles of the mouth and the lips, which are liable to irritation by the bit, &c.; the inner aspect of the fetlocks, more especially in horses given to habitual "brushing"; the prepuce; the lachrymal region, &c. The results of operation have likewise proved most unsatisfactory in the case of Barsati as in that of human cancer. I. V. S. Oliphant* writes: "The state of the system existing in Barsati is not one that indicates the use of the knife;" and Dr. Walshe says, "Cancers which have become quiescent have sometimes been cut out, and the operation been followed by rapid reproduction of the disease." Dr. Cooke writes: "From 1851 to the end of 1863, we have had the opportunity of seeing at the Cancer Hospital 413 persons who had been operated on for cancer; and it will astonish the reader to be told that the average lapse of time before the disease returned in these cases was no more than *six and a half months*."† The experience of veterinary-surgeons in India shows that Barsati sores which, under appropriate treatment, generally subside about the end of September, re-develop their activity next March, April or May.

* Veterinary Journal, July, 1880, p. 18.

† On Cancer: Its allies and counterfoits, pp. 92-3.

We have already shown that the presence of tubercle-like nodules in Barsati sores is diagnostic. And Dr. T. Weedon Cooke, on the subject of cancer in man, on page 93, writes: "In many cases the incisions made for the purpose of removing the diseased mass have scarcely healed before '*tubercles*' have appeared around the cicatrix, or the wound itself has taken on the diseased action." Dr. Green* says: "The cells may be so closely packed as ultimately to become hard and dry like those of nails and hair, and the globes are then of a brownish yellow colour and of a firm consistence. These globes are often large enough to be readily visible to the naked-eye." Professor Billroth considers the presence of nodules in the skin, when numerous and well-characterised, *diagnostic* of one variety of cancer he has specially studied in Europe.

In their general history, clinical and post-mortem characteristics, course of development, and in the nature and extent of influence producible upon them by treatment, Barsati in the horse and cancer of man are identical. Excepting perhaps the lesser fatality in herbivorous animals noted by M. Leblanc,† there is perhaps no feature of Barsati which may not be observed in cases of human cancer. Some of the above facts, I trust, may help accurate diagnosis, for I am of opinion that under the name of Barsati are often included a host of other diseases which have only a surface or chance resemblance in common. It is the custom at the present day to call every ulcer which is long in healing "*Barsati*." I trust this will not influence future diagnosis. On the other hand, a simple wound may precede the development of true Barsati by weeks or months. Analogous to this form of disease is epithelioma in the human subject, as a sequel to psoriasis of the tongue. Many veterinarians must, like myself, have met with many cases of Barsati originating in simple sores.

Recurring Nature.

It is said that recession of the sores is peculiar to Barsati only, but I am not enabled to endorse this opinion. It is well known that alternate cessations and recurrences of the sores characterise human cancer

*Green, *Morbid Pathology*, 1878.

†Recueil de Med. Veterinaire, 4th Series.

quite as much as they do Barsati. Dr. Campbell de Morgan, F. R. S., writes*: “A remarkable and not very explicable phenomenon is the arrest of cancer growth and the gradual wasting of the diseased mass. The activity of the whole mass is arrested, new cells cease to be formed, and the tumour fades—a widely spread mass becoming quiescent and then fading throughout its whole extent. It shifts the difficulty back a stage or two to suggest that the recession of cancer takes place in obedience to the law under which local atrophy, independent of inflammation or disease, may occur; or that it may be due to some want of organising power inherent in it from the first, as some cancers seem born to be atrophic. It is, under any circumstances, a most important subject for investigation.”

From the foregoing remarks it must not be concluded, however, that the period of respite due to atrophic change, is an invariable feature of Barsati. Not by any means has such been found to be the case in our experience of this disease; for, it is usually noticed in the milder cases only, where constitutional symptoms are also absent; whereas it is not at all uncommon to see sores existing before and persisting throughout the winter as well as during the summer. In many cases the disease runs its destructive course in a few months. Had our knowledge of cases ended when the disease first showed signs of local arrestation, we should have been compelled to adopt the prevalent theory of reported cures; but fortunately our cases have gone further, and in too many instances revealed the nature of our panaceas. It is not at all unlikely that some of us have the opportunity of seeing this disease, in our equine patients, at an earlier stage than others generally see it; and sent as these patients are for treatment after repeated recurrences, we rarely have an opportunity of testing the precise value of many vaunted remedies during its different stages. Experience has shown that recurrence of Barsati is not confined to the wet weather. It remains to be acknowledged, however, that though this is the case, yet, the disease having once established itself, its return *in loco* is rendered probably more certain during the rains than in any other season. The

*Med. Times and Gazette, 7 March, 1874, p. 256.

fact itself, we may observe, appears inexplicable to many who recognise it as such, but its causes are, notwithstanding, capable of explanation; for, as Dr. Moxon* has observed, moisture intervenes, together with the other unfavourable influences of accompanying heat, etc., during wet weather, which augment cell-growth in cancer structures. The effect of moisture in the atmosphere during the rains, therefore, is an increase of cell-activity and a general acceleration of all the worst accompaniments of Barsati.

Necropsy.

Inasmuch as kankers are perhaps the most noticeable morbid change found in the internal organs, we may begin with a consideration of them, and describe the other changes afterwards.

(a) "KANKERS."—They are found in the lymphatic glands, in the lungs, liver, spleen and other organs. In the latter, they may be either deeply imbedded, or seated superficially on the surface and on fibrous and mucous coverings. They are both discrete and confluent, are of various sizes, shapes and forms, and of different consistency during different stages of development. Some of the youngest, seen on the surface of the lungs, appear slightly depressed in the centre, giving the surrounding pleura a peculiar puckered appearance. Those older in the stage of development, are harder to the feel, have an irregular outline and, when seated on the pleura, are slightly raised above the surface of the lungs, and surrounded by a zone of fibrous or cirrhotic tissue. Histologically, these kankers differ in no respect from similar kankers found in the sores externally seated. In some places they produce, by confluence, characteristic "lumps" in the substance of organs, but particularly in that of the lungs. The irritant which produces Barsáti nodules in remote structures is merely a tissue irritant derived from the external sore, and acts embolically; the caseation that sometimes follows is a mishap due to insufficient blood supply; while the later change of calcification is due to infiltration of this structure with inorganic salts. Caseation of a Barsáti nodule

*Moxon, "Trans. Path. Soc.," XX, 28. See Arnott "On Cancer," 1872, p. 70.

takes place generally as a result of complicity with other products and from insufficient nutriment, which accounts for the infrequency with which yellow nodules are here met with; and, in this respect the disease differs in an important particular from tuberculosis. It is commoner, as experience shows, to meet with the grey formations, and those which have undergone that physical variation by transformation into a horny mass, called cornification, or by infiltration with inorganic salts into 'womb-stones' or *kanker*.

(b) CONSOLIDATION.—Many portions of the lungs undergo consolidation, the result of catarrhal inflammation, and produce, what may be called, a peculiar *cloudy degeneration*, due to the air vesicles being occluded with catarrhal products, in which may be seen numerous large, polygonal or hexagonal cells having ovoid nuclei and many nucleoli. The air septa are also the seat of a dense infiltration by numerous small cells. Auscultation over parts of the chest corresponding to such portions of the lungs shows loss of murmur of the normal sounds of the lungs, during life. The consolidation is frequently a result of fibroid change in many advanced cases. Dulness is sometimes, but not always, detected, because frequently the surrounding lung is super-resonant from emphysema. Gradually the lungs become more and more extensively involved, and the signs, as well as the symptoms, are not to be distinguished from those of any other chronic lung affection.

(c) THE PLEURA.—Is the seat of important and marked changes in the advanced cases of this disease. It loses its normal transparency, becomes rough to the feel, and cloudy in appearance, and is thickened and adherent to the subjacent lung-tissue from increase in development of the interposed connective tissue. In specimens steeped in alcohol, this is beautifully shown, the pleura being raised into distinct *rugæ*.

(d) FALSE BRONCHI.—Small cavities appear on section of the lungs resembling true bronchi, but which on inspection are found to be *cavities emptied of kanker*, and indicate the seat of *kankers* which have been dislodged in the act of sectioning. True dilatation of the bronchi may be seen in many long-standing cases of Barsáti, due to cirrhosis: the

cirrhotic tissue contracting, pulls the bronchi open on principles well recognised.

(e) EMPHYSEMA.—When any portion of the lungs is consolidated, the adjacent parts take on increased or excessive action, one of the results of which is emphysema, the amount of which will always be regulated by the amount of consolidation present in any given case.

(f) PHLEBECTASIS.—Or a dilated, corded condition of the bloodvessels of the lungs, generally of the subpleural vessels,—also results in a few cases, from compensatory action.

No suppurative changes are usually noticed in any of the internal organs in cases of Barsáti.

Treatment.

Many observers exalt special remedies in the treatment of Barsati, and as usual, each produces a list of cures in favour of his favourite application. Further evidence of the difficulty of settling this point is afforded by general experience, which disproves the utility of these cures, and shows that their benefits have been overestimated. It is now proved that it is impossible to influence the course of Barsati by recourse to any number of acknowledged parasitocides which have been recommended; and I have myself tried, in numerous cases, local applications of caustic potash, nitrate of silver, chloride of zinc, chlorate of potash,* sulphate of copper, of iron and zinc, salicylate of soda, salicylic,† nitric, sulphuric, acetic, and carbolic acids, myrrh, aloes, camphor, alum, sulphur, &c., without effect. Iodine and sulphurous acid injections have been latterly tried by me in many private cases, with equally useless results. Mr. T. Marriott, A. V. D., speaks very highly of the results of treatment by iodoform. Very extensive Barsati growths on the fetlocks and lower lip and angles of the mouth have been gradually destroyed by caustics followed by iodoform dressings, and a healthy cicatrix has been obtained. How long an immunity from this disease has been secured, it would be difficult to say; but at any rate it is a considerable gain to have overcome, even for a time, the unsightly and

* Berl. klin. Wochenschrift, No. 6, 1873.

† Wien. Med. Wochenschrift, No. 24, 1883.

ever-increasing out-growth, and to have thus early relieved the animal from pain, and returned him to duty. Calomel and biniodide of mercury were largely employed in the Government studs some years ago, but with no better results than any of the above mentioned. Carbolic acid, when well diluted, has the effect of cleaning the surface; but when in strong solution, undoubtedly aggravates the growth in many cases. For the purpose of removing discharges from the surface, and keeping the sore free from smell, I never employ a stronger solution than 1 part in 20 parts of water, for the reasons above stated. Its efficacy, however, is no greater than that of most other agents in common employment. Mr. John Henry Steel, A. V. D., recommends the iodide of arsenic ointment (1-6) as a useful application, to cause a slough. The use of the actual cautery and of the knife is in every case contra-indicated, as it generally increases the activity of the growth. Thus we have tried every remedy, and during every stage of this disease, with the same negative results. At the risk of appearing tautological I would add one other remark upon these operations by the knife, actual cautery and caustic agents. "Be quite sure that you remove *all* the induration, or you will do mischief instead of good." I might give a long list of "successful cases," such as are frequently recorded in the veterinary journals; but as I know from experience such cases have returned for treatment after they had been passed as "cured," I set no value on these temporary successes, and look upon them as mere compromises, which advancing knowledge will enable practitioners to discard, for a more radical and permanently successful treatment. So long as we continue to look upon Barsati as a mere local disease, so long shall we fail to effect more than a temporary recovery.

Where Barsati is indolent, it is wise not to attempt its removal by the knife or by any caustic applications. Such indolence or arrested growth in an external sore is sometimes coincident with its internal development. Inspecting Veterinary-Surgeon Oliphant says—"The state of the system existing in Barsati is not such as indicates the use of the knife." Dr. Walshe, after condemning operation for the relief of human cancer, quotes Dr. Macfarlane, who "could adduce the cases of several

patients who had laboured under cancer for ten, fifteen, and twenty years, who were cut off in three or four months by an operation."

Pari Passu with the advance of the external sore I have noticed defects produced in the constitution of the animal, which should be early supported by appropriate medicinal remedies. The results of this combined treatment will be generally found to be more satisfactory, although how long an immunity from this disease may thus be secured in all cases I am unable to say, but at any rate it is found to be a considerable improvement on the local treatment only, and affords better hope of restoring the patient to work and keeping him out of sick-beds long after others have been admitted with a locally recurrent disease of aggravated character. I know from early experience that it is no good "patching up" a case and returning to duty, which comes back in a few months with considerable constitutional disturbance. I know of no specific remedies that will avert the constitutional derangement, but would recommend the system to be supported on general principles, by the administration of both vegetable and mineral tonics, but especially by iron and arsenic in large doses. Any of the preparations of phosphorus might also prove useful. The influence of phosphorus and arsenic on the general nutrition is analogous to their influence on the nutrition of the skin and subcutaneous tissues, which is seen in the case of many skin affections.

Our search for agents to neutralise and destroy this disease in its local aspects should lie in the direction of those which shut it up, or encase it, is it were, by hardening its cells. The subcutaneous injection of medicines promises the most likely means of doing this. The best agent which will effect this is chromic acid, which in the field of the microscope is seen, even in a solution as dilute as one part in a thousand of water, rapidly to define, as if dissecting out the delicate cells, hardening and enclosing the nuclei, closing up their walls, and so preventing the diffusion of their contents. Professor Billroth's use of this agent as subcutaneous injection in lymphoma of the human subject, gives encouragement to the trial of the same in equine Barsati. Akin to the action of the subcu-

taneous injection, the use of chloroform in external application bids fair to be useful in the treatment of local Barsati. It is a most useful "carrier" to vegetable alkaloids, promoting their absorption. Its action in causing the absorption of vegetable alkaloids seems to depend upon the removal of the cuticle, thus exposing the absorbing surface of the cutis vera. Professor Trinchera,* of the Naples Veterinary School, believes he has cured cancer of the penis and scrotum in the carnivora, by early operation, the wound being dressed with chlorate of potash. Malthe recommends combining iodoform with nitrate of silver as a caustic and healing application in all chronic ulcers. The ulcerated surface is sprinkled with iodoform, on which the nitrate of silver is next applied, and on this again iodoform. A brisk effervescence of nitrous acid and insoluble iodine and chloride of silver results. This may be employed with much benefit in Barsati ulceration of not long duration, and where the subcutaneous tissues have not been deeply implicated.

The above remedies have been prescribed by me in many cases with good results, where constitutional disease was not already far advanced. No one remedy can be expected to produce a cure, and this alone illustrates the absurdity of the dogma, that any "specific" can eradicate a general disease by treating its local manifestations only. We must at present hope for a mere gradual suspension of local disease by treating on general principles.

I have given the above summary with the view of furnishing a general experience in regard to results of different modes of treatment in different cases. Most of the remedies mentioned have been tried by me as well as other practitioners, in the treatment of this disease. I have, however, to say something further of certain preventives which have not been described before, and which come under the first category in the preceding summary. Those cases in which the sore has apparently been of short duration may be much benefited by a change of climate to the Hills. Those in which the constitution is severely involved may derive temporary benefit by a similar change. But in some cases the result is disappointment: the local disease persists and grows in spite of all

*Giornale delle razze degli Animale utili e di Med. Veterinaria, 1875.

treatment, and sometimes fresh ulceration takes place in an already healed cicatrix, so that the treatment of Barsati must be considered only palliative in kind. When the disease has been suppressed by the abovenamed means, a relapse is rendered less certain if the animal is kept on a strictly starchy diet. It would appear that the greater sensitiveness—that is, irritability or susceptibility of the skin and tissues generally—which is associated with high feeding and higher organization, is, in a measure unfavourable to reparative work. We can quite conceive that the steady, regular processes upon which it depends are less likely to proceed in an orderly and uninterrupted manner under conditions of high excitability, where stimulus easily engenders disorder, than under lower functional activity and less susceptible circumstances. Herein, possibly—namely in the greater excitability of their tissues may be found an explanation of the reasons why cancer changes should be as a rule more pronounced in highly-fed animals, as the carnivora, than in herbivorous animals, and of which it is practically important that we should take due account.

We are not assured that Barsati is hereditary in its character. Colonel McDougal, Superintendent of central Government studs, tried to show from statistics that it was so. A safe practical conclusion to arrive at is, that all stallions which have suffered from this disease, although temporarily recovered from it, should be castrated, and brood mares similarly affected be disposed of by auction sale: they should not be retained for breeding purposes.



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BARSÁTI, OR EQUINE CANCER.

BY R. W. BURKE, A. V. D.

Printed at the Medical Press, Cawnpore. 1886.

ENGLISH literature has dealt exhaustively with this disease, which appears to be very frequent in India, and is a cachexia which gradually destroys the animal by producing a special dyscrasia. The pathology, symptomatology, and therapy of this disease have been very thoroughly examined into. The malady appears principally in the less elevated parts of India. Heat and dampness appear to aggravate the disease, and also to favour the growth of parasites. According to Burke, barsáti is not a contagious disease, as animals standing next to affected ones have never been known to contract the disease. All animals, of every condition, are liable to the disease, but those of a robust condition are specially subject to it. Frequently it has been found to originate in simple sores, which gradually become indurated. It is brought on chiefly through a slow, continued irritation of the parts, especially on the muco-cutaneous and cutaneous surfaces, as on the lips, eyelids, prepuce, fetlock, &c. There is no inflammatory action present in the sores. Small tubercular nodules are found in the sores, which produce ulcerations. In the early stages there may be very few or no nodules present; but in the latter stages they are usually very abundant. The disease generally subsides at the close of the rainy season, towards the end of September, and recurs in March, April, or May. The apparently healed barsáti spots remain tender for some time afterwards, attended with irritative action. At the same time the lymphatic glands become involved in cases where marked ulceration has taken place. Metastases occur in the internal organs, such as the lungs, liver, spleen, &c. Simultaneously with these local recurrences and metastases in internal viscera a cachexia sets in. The progress of the disease is seldom rapid, as it usually extends over a period of several years in most cases. The results of treatment show it to be similar to human cancer, except that it is found to be generally less rapid in its course in the herbivora, as shown by Beneke, than in man. The only diseases

with which it may be mistaken are rodent ulcer, Delhi boil or lupus, keloid or chakáwur, and ichthyosis. Only the slighter forms of barsáti, however, can be mistaken for ichthyosis. Microscopic examination will in most cases settle the diagnosis. The peculiar birdnest-like formations, which are characteristic of human cancer, appear also in cases of barsáti, and lead to the formation of little nodules, known under the name of kankers (*krebsknoten*). There is present also a great tendency to the formation of fibroid tissue in barsáti. Burke proposes the name of atrophic cancer for this disease. *Post-mortem* examination shows the presence of kankers in the lymph-glands, in the lungs, liver, spleen, &c., which may be superficial or deep-seated, and of different consistency, the youngest of them being slightly depressed in the centre, and slightly also softer in consistency than the older ones, which often acquire a stony hardness, and may be covered or surrounded by a dense cirrhotic tissue. The nodules in the lungs lead to destruction of large patches of the lung tissue, and the alveoli become filled with a catarrhal exudation, leading to a cellular infiltration of the surrounding tissues, and consolidation. In the more advanced parts a fibroid change may be noticed. The neighbouring pleura is also frequently involved, leading to dulness and thickening of that membrane. The nodules in the internal viscera have seldom been seen to lead to any ulceration. They are surrounded by a growth of fibroid tissue in excess of that found in tuberculosis. Often the nodules are seen to present a greyish colour, and are of a horny or chalky consistency, resembling cartilaginous tissue. The treatment has hitherto proved useless, as none of the numerous remedies mentioned can be relied upon in all cases. In the larger growths iodoform has been sometimes found useful. To correct the cachexia, palliative treatment is recommended, such as arsenic, phosphorus, and iron, &c. Still the prognosis is always unfavourable, as the disease gets gradually worse and worse. Its hereditary nature is doubtful (*Deutsche Zeitschrift für Thier-medicin u. vergl. Pathologie*, 1886.)

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BARSÁTI, OR EQUINE CANCER,

By

RICHD. W. BURKE, A. V. D.,

Station Chief Veterinary Hospital, Jabalpure.

The pathology, symptomatology and therapy of this disease have been very thoroughly examined into. (*Deutsche Zeitschrift für Thiermedizin u. vergl. Pathologie*, 1886.)

The book contains much of interest and practical importance.—(*Quarterly Journal of Veterinary Science*, 1886.)

It deals thoroughly with the pathology, clinical characteristics, recurring nature, and diagnosis, and also gives full and useful instruction as to the best method of treatment of this disease. We strongly recommend this work.—(*The Asian*, 10th August, 1886.)

VETERINARY SURGICAL PATHOLOGY.

(Translated into Urdu, 1885.)

BY

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With numerous illustrations, mostly from original drawings and photographs.

The British Medical Journal, January 22, 1887, says:—It presents to us complete and modern instruction in an important branch of veterinary knowledge. We commend the work as one of considerable merit, and as an interesting proof of English enterprise.

The Veterinary Journal, March, 1887, says:—There is a good deal that is novel in the book, and this, added to its high scientific tone in the pathological and histological descriptions, cannot fail to impress the native mind devoted to such a study. The authors undertook a heavy task, and have got through it in a remarkably complete and satisfactory manner.

The Quarterly Journal of Veterinary Science, October, 1886, says:—A most valuable feature is the notice taken of the disorders of Indian Transport Animals, such as the elephant and camel, and we believe that to the Messrs. Burke belongs the special credit of having first incorporated lessons derivable from the pathology of those animals into a systematic work on veterinary science. The book is well calculated to do the State some service, by in an effective manner filling the gap thus indicated.

The Journal of Comparative Medicine and Surgery, October, 1886, says:—The illustrations are numerous and valuable, many of them being from original designs of the authors.

